E. Eugene Walker

METAL FINISHING

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

Founded as Metal Industry, January, 1903
by Palmer H. Langdon, 1868-1935

Editorial and Business Staff

L. H. LANGDON, *Publisher*
PALMER H. LANGDON, *Assistant Publisher*
THOMAS A. TRUMBOUR, *Business Manager*
JOAN T. WIARDA, *Sales Manager*
WALTER A. RAYMOND, *Engineering Editor*
FERDINAND C. WEHRMAN, *Western Editor*
FRED A. HERR, *Pacific Coast Editor*
JOHN E. TRUMBOUR, *Equipment & News Editor*

Published Monthly by

FINISHING PUBLICATIONS, INC.

founded 1903 as
Metal Industry Publishing Co., Inc.
11 West 42nd St. New York 18, N. Y.
Telephone: PEnnsylvania 6-0226

Branch Offices

Chicago 11
612 N. Michigan Ave.
WHitehall 4-1920

Los Angeles 13
424 S. Broadway
MAdison 6-5421

also publishers of
Organic Finishing, monthly, $3.00 per year

Copyright 1949 by Finishing Publications, Inc. Entered February 25, 1903, at New York, N. Y., as second class matter under Act of Congress, March 3, 1879. Re-entered as second class matter June 13, 1940, at the post office at New York, N. Y., under the Act of March 3, 1879.

SUBSCRIPTION PRICES: United States, $4.00 and Canada $4.00 per year. Other countries $8.00. Single copies 45c in U. S. and Canada, Foreign 85c. Guidebook-Directory published as separate volume in pocket size form $1.50. 1948 edition current. Please remit by check or money order; cash should be registered.

Contributed articles, communications, etc., on pertinent subjects are invited. Their publication, however, does not necessarily imply editorial endorsement.

JANUARY, 1949 VOLUME 47 • NUMBER 1

CONTENTS

Editorial 43

Technical Progress in Metal Finishing During 1948 44
By Walter A. Raymond

Throwing Power of Electroplating Solutions—Part II .. 54
By A. Mankowich

pH—Its Meaning and Determination—Part I 56
By Howard Sanders

Keeping Costs in the Plating Room 62
By Philip J. Sievering

Decorative Finishes for Lead 64
By Kempton H. Roll

Shop Problems 68
Patents 70
Engineering Data Sheet 73
Recent Developments 74
Business Items 83
Associations and Societies 88
Manufacturers' Literature 94
News from California 95
Technical Literature 97
Obituaries 98

COMING SOON

The second of a series of articles on the importance and measurement of pH in plating and cleaning baths, with a discussion of the electrometric method of measurement.

A discussion of the factors affecting the ductility and bending qualities of hot-dipped zinc coatings on steel.

Abrasive methods for the preparation of metal surfaces for finishing, including sand blasting, shot blasting, and liquid abrasive blasting.

Barrel finishing of critical parts for improved surface finish and burr removal.

LEA METHOD COMPOUND

PRECISION FINISHING

for

AMERICAN OPTICAL COMPANY

The American Optical Company, manufacturer of SPENCER Scientific Instruments, uses a LEA Method and LEA Compounds for finishing many parts on their well-known No. 820 Microtome. This is a precision instrument widely used in hospital and laboratory work—work that demands the utmost in precision manufacture and finish.

A LEA Method plus the proper grade of LEA Compound is outstandingly successful for high speed, close-tolerance finishing. If you are burring, polishing or buffing metal or plastic parts, why not consult with our engineers? Our recommendations may cut your costs, increase your volume and improve the quality and appearance of your finished product.

The Spencer No. 820 Precision Rotary Microtome

THE LEA MANUFACTURING CO.

Burring, Buffing and Polishing... Manufacturers and Specialists in the Development of Production Methods and Compositions

16 CHERRY AVENUE • WATERBURY 86 • CONNECTICUT

ESTABLISHED 1903

EVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

OLUME 47 • NUMBER 1 • JANUARY, 1949

METAL FINISHING

Outlook for 1949

If any one thing could be singled out as being conspicuous during the past year, it would be the overwhelming evidence that the purchaser had thrown off the tattered beggar's cloak after many long, weary years and had once again donned the royal purple of the pre-war buyer.

For the harassed consumer of finishing materials this provided a certain latitude in choice of materials and the possibility, at least, of maintaining finishing costs in spite of higher prices for equipment, materials, and labor. For the producers and suppliers it presented a real challenge in promotion and selling, reflected by the many changes in executive sales personnel and sales policies noted during the year.

We look for this trend to continue in the coming year, as the demand for higher quality finishes at lower cost will not slacken its pace. Pressure on the finisher will thus be reflected all along the line. Essentially the same shortages of certain materials will continue, notably steel, aluminum, chromic acid, and cadmium, but other than these the supply situation should be considerably eased. Skilled labor will provide a brighter spot in the picture than it has heretofore.

All things considered, 1949 should follow along the same lines as last year, and as 1948 can justifiably be called a "good" year for the metal finishing industry, the outlook for the next twelve months is bright and encouraging.

Happy New Year

Technical Progress in Metal Finishing During 1948

By Walter A. Raymond, *Engineering Editor*

THE year 1948 cannot, as a whole, be regarded as a "great" year in the metal finishing industry. However, this does not mean that progress wasn't made nor that new records were not established along certain lines of activity. Substantial progress was made, but it was the unspectacular, sure-footed type of progress resulting from prolonged development and research, unhurried by the urgencies of war production or peacetime reconversion.

General business activity continued at a high level, although hampered somewhat by a continuing shortage of materials and chemicals, notably steel, aluminum, chromic acid, cadmium, nickel, and caustics. Competition was keen, as most sales departments will testify, and increased emphasis on quality and customer service were of primary importance in maintaining a high sales volume.

The job plating branch of the industry suffered somewhat, due mostly to the better availability of equipment which allowed many firms to expand or operate their own finishing facilities. Some failures of jobbing shops resulted, but this was a natural and expected development in the wake of seven years of frantic and at times haphazard activity.

The labor situation was considerably improved over previous years, especially in the polishing and buffing field, although it cannot be said that there is yet an adequate supply of skilled polishers and buffers available. This, together with the greatly increased wages for such labor, had led to greater use of automatic polishing and buffing equipment, bright plating, and electropolishing techniques. The latter field particularly has shown wide activity, as will be brought out in a later part of this discussion.

Modern laboratory for electrochemical research in the plant of a large industrial manufacturer. In addition to control of their products, basic research is carried on.

A significant note in the past year's progress is the wider use of electrodeposition as a means of producing surfaces for other than decorative applications, where advantage is taken of special properties such as high hardness, heat and oxidation resistance, electrical conductivity, and ability to reproduce fine detail. Such engineering applications foretell increased research and development of the basic processes of electrodeposition that will affect the entire industry.

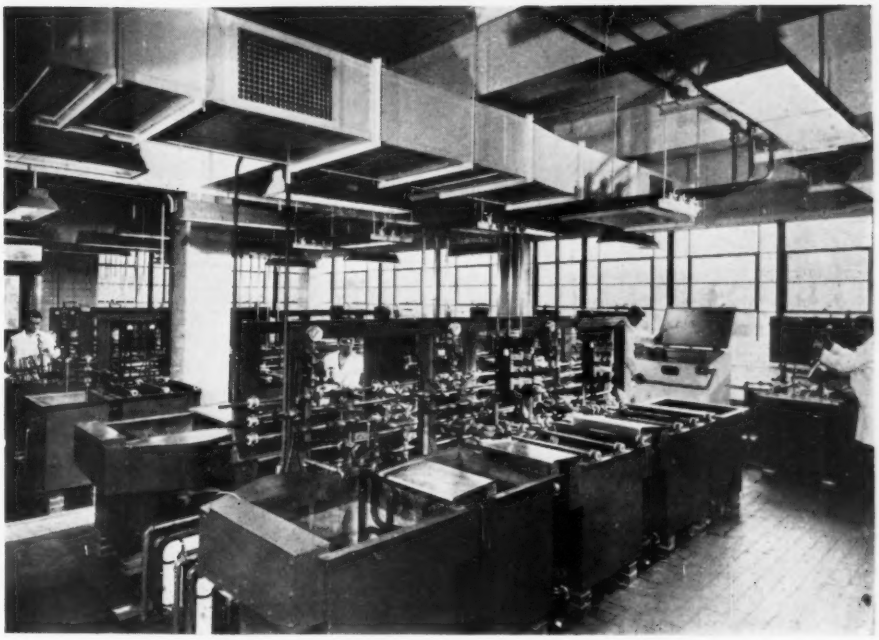
In the following pages will be found a brief review of the more significant advances of the past year.

Theoretical

In view of the wide interest in atomic energy and nuclear physics, it was only natural that the processes of electrodeposition be examined from that angle[1]. Several very interesting avenues of research were suggested in this article and the series by *Kushner*[2] on the influences of purely physical factors. One of these factors, pressure, was studied by *Webb* and *Linford*[3] on copper cyanide solutions. They found that decreased pressure on the bath resulted in increased efficiency, and they derived a mathematical relationship between efficiency, pressure, and current density.

Steer[4, 5] studied the effect of metal surfaces on the subsequent electrodeposition process and pointed out, among other things, that a "flowed" metal surface gives rise to poor adhesion and peeling, while a crystalline surface promotes adhesion of an electrodeposit. He further defined peeling as being of three principal types—stress exfoliation, corrosion exfoliation, and a combination of both, and showed how the "flowed" surface caused stress exfoliation, while corrosion exfoliation was due to the lifting effect of the corrosion of the base metal through chemical attack starting at pores or pinholes in the deposited metal.

The nature of passivating films on stainless steels was studied by *Mahla* and *Nielson*[6], by separating the films from the base metal in a bromine-methanol solution and subjecting them to microscopic and diffraction analysis. They found that the films contained both chromium and iron as major constituents, probably as a solid solution.



Research laboratory recently installed by a prominent manufacturer and supplier of finishing equipment and materials. Pilot studies and customer service work are performed.

Keller and *Edwards*,[7] in a similar study of the natural oxide films on aluminum, concluded that such films were amorphous and that they formed immediately after previous films had been removed. The properties of the films were found to be considerably influenced by the method used to remove any prior oxide film, aqueous removal reagents producing subsequent films of greater resistance to attack, whereas this was not true of mechanically removed films. This would seem to indicate that removal of surface oxide films by brushing or polishing would be preferable to chemical removal when subsequent processes require the absence of an oxide film of high resistance to attack.

Polishing, Buffing

In the field of mechanical polishing and buffing, the most significant developments were in the line of wider adoption of automatic equipment, abrasive belts, and sprayed abrasive compositions. The development of polishing heads for automatic equipment that can accommodate either headed wheels or abrasive belts added another valuable tool to the industry. The increased popularity of abrasive belts was due primarily to the improvement in bonding methods and adhesives, permitting much longer cutting life when used where heat is developed. The use of sprayed abrasives in polishing and buffing has demonstrated increased production and lowered material costs, and further improvement of spraying equipment can be expected to enhance these advantages.

Electropolishing & Chemical Polishing

As mentioned in the opening remarks, electropolishing became more firmly established as a step in many metal finishing procedures, principally for surfacing stainless steels and copper alloys. The successful application of the method in several large commercial installations has caused nearly every person responsible for finishing results to examine the process with a view to his own requirements, and this should materially broaden the field of application.

Wein[8] reviewed the development of electropolishing, and listed various baths developed for the commercial metals, and *Berger*[9] described a bath developed for polishing brass parts and the commercial installation of the process.

Haljawy[10] studied the electropolishing of copper in phosphoric acid baths, and showed that the diffusion layer plays a most important part in the process, as it was possible to get polishing action or etching action depending on whether or not this diffusion layer was disturbed by agitation, and also that electropolishing took place at much lower current densities than normal if the diffusion layer was not disturbed.

Numerous patents were granted for electrolytes. *Faust*[11] obtained a patent for a phosphoric-sulfuric bath containing a small amount of trivalent aluminum and trivalent chromium for polishing nickel. *Faust* and *Miller*[12] were granted a patent for continuously electropolishing nickel wherein the dissolved nickel was recovered by deposition on the cathode. The bath was a mixture of phosphoric and hydrochloric acids, or phosphoric-sulfuric-hydrochloric acids. Deposition of metallic nickel on the cathodes eliminates the former problem of bath build-up and crystallization of nickel salts.

Field obtained two patents for electropolishing stainless steel. The first[13] involved the use of alternating current only in a bath of nitric and acetic acids. The second[14] also used only alternating current in a 80% aqueous nitric acid electrolyte.

Polishing metal surfaces by immersion only, without the influence of electrical currents, also came in for some important advances. Two new processes for chemical polishing of aluminum and its alloys were made commercially available[15, 16], both of which produce a bright finish on wrought alloys. *Wieczorek*[17] was granted a patent for a bath for smoothening zinc and zinc alloy surfaces, which consisted of acetic-sulfuric-chromic acids. Treatment in this bath was followed by a caustic dip.

Electropolishing of silver and silver plate developed into a standard operation in many plants during the past year.

A bath for chemical polishing of copper alloys, nickel, and Monel was patented by *Pray*, *Igelsrud*, and

Simard[18]. The bath was a mixture of nitric, phosphoric, and acetic acids.

Cleaning and Pickling

Abrasive Blasting

With the increased concern felt by most finishing shops over the problem of waste disposal, more attention to non-chemical methods of scale and oxide removal is being paid. The wet abrasive blasting methods[19] recently developed have demonstrated a potential usefulness, in that very fine abrasives can be used to produce smoother surfaces, remove sharp corners and burrs, etc. The utilization of soft grits, such as crushed coffee beans, rice hulls, coconut shells, and other similar materials has been reported by *Albin*[20] to effect removal of surface soils without eroding the softer metals.

Molten Salt Baths

Several new processes for molten salt bath cleaning have been reported during the past year. *White*[21] was granted a patent for cleaning aluminum alloys in molten Ammonium Fluoride at 240° F, and *Evans*[22] patented a molten bath of caustic and cyanide for use on metals other than zinc at 300-600° C. A molten bath for cleaning and copper plating steel simultaneously was developed by *Clenny*[23]. The bath is fused caustic soda containing 1-10% copper oxide at 400-500° C. While the parts are immersed, a D.C. current is passed through at about 150-200 amps/ft^2, with the parts first anodic, then cathodic, repeating the reversal cycle at lower current densities to get a good coating of copper on the parts. The high temperatures involved will restrict the use of the method to special application.

Electrolytic Pickling

Weller[24] reviewed the entire field of electrolytic pickling, including acid, alkaline, anodic, and cathodic methods. *Zapffe*[25] studied the mechanism of electrolytic descaling, and concluded that the action was due to the returning to the surface of the highly compressed hydrogen gas absorbed by the metal in the early stages of the process. A patent was granted to *Cannizzaro*[26] for cleaning tungsten for plating, which involved a low alternating current treatment in a solution of hydrofluoric acid.

Acid Pickling

Darken and Smith[27] studied the absorption of hydrogen in steel, and stated that the hydrogen absorbed was principally trapped in imperfections in the crystal lattice, that the gas was absorbed at a faster rate than it was expelled, and that cold worked steel had a much higher absorption ability for hydrogen than hot worked material.

A study of the effect of inhibitors in acid pickling baths was made by *De Lattre*[28], including ketonic compounds, thioderivatives, quinoline, and many others, all of which he classified into 3 basic types.

The use of wetting agents in acid inhibitors was investigated by *Cardwell* and *Eilers*[29], who found that the presence of wetting agents in acid solutions containing organic inhibitors reduced the corrosion of the metal. They ascribed this partly to the reduction in size of the hydrogen bubbles, causing less of the etching type of attack.

Alkaline Cleaning

The effect of free fatty acids in oil on the ease of cleaning in alkaline baths was investigated by *Spring* and *Peale*[30], who found that additions of free fatty acids facilitated removal of the oils, except in the case of sulfurized fatty or fatty oils, in which case it was found harder to remove such oils if the free fatty acid was as high as 10%. The same results were obtained by additions of oil-soluble sodium sulfonate soaps in each case.

Middleton[31] studied the use of silicates in the cleaning of zinc die castings. His results indicated that when used as a cathodic cleaner, no films formed on the parts at all alkali-silicate ratios, but that when used as an anodic cleaner the disilicate and trisilicate could not be used, due to the formation of white films on the work. The metasilicate and sesquisilicate were found to give film-free cleaning with both types of cleaning, when used within certain concentration limits. He gave recommendations on concentrations, temperatures, and current densities for both cleaning methods on zinc and its alloys.

A study of di-phase cleaners was conducted by *Reich* and *Snell*[32] who measured contact angles, oil displacement, effect of soaps, effect of soil types, the important part played by the surface, and the relation of the stability of emulsion cleaners to cleaning efficiency.

General methods for cleaning aluminum for plating, anodizing, spot welding, etc., were discussed by *Durkin*[33], who measured the surface resistance after treatment as a test for oxide removal. His results did not take into account the conclusions reached by *Keller* and *Edwards*[7], who stated that the oxide film formation after cleaning depended to a large extent on the cleaning method used, and therefore could not be taken as a measure of oxide-removal efficiency.

Pope[34] also gave recommendations for cleaning aluminum before various processing operations, pointing out the advantages of removing oxide films to facilitate buffing.

Wetting Agents

The development and use of wetting and surface-active agents grew rapidly during the past year. It has been estimated that the total tonnage of wetting agents produced for all uses was about 1/6 that of soap, indicating a tremendous increase in application, especially when it is remembered that such agents are used in much smaller amounts for a specific application than are soaps.

Price[35] discussed the chemistry and properties of various surface-active agents and their application to cleaning and plating operations. Special applications

of these materials to various processes are discussed elsewhere in this article.

Evaluation of the effective wetting power of surface-active agents was studied by *Hyypia*[36], who measured the rate of spread of the material on various surfaces by high speed photography and found that the rate of spread is a function of the nature of the surface being tested, and that agents of similar ionic type exhibited characteristic spreading when tested on the same types of surfaces.

The widespread use of surface active agents will require methods for their determination in solution, and *Barr, Oliver* and *Stubbings*[37] reported on a method for the direct titration determination of anion-active and cation-active material, by a partition end-point technique.

Stripping and Bright Dipping

A method for stripping rhodium plate from nickel-plated parts without undue attack on the base metal was reported by *Shapiro*[38]. The method involved anodic treatment in a 55-56° Baume sulfuric acid at 90-100° F for about 45-60 mins. The rhodium was recovered as metal in this process.

The polysulfide method for stripping copper from steel and zinc-base alloys was the subject of a report by the AES Research Committee[39]. It was found that dilute solutions of sodium polysulfide gave a loosely adherent sulfide film that could be easily removed by a jet of water, and that removal of .001" of copper in about 2 minutes' immersion was possible with this solution. A slightly less alkaline sulfide solution was found to be better for zinc-base alloys, followed by a short immersion in sodium cyanide solution. Deplating in cyanide bath was also studied[40] and the effects of stirring, addition agents, pH, and base metal were checked against the bath life and efficiency.

Thompson and *Moline* obtained a patent[41] for a bright dipping and deburring bath for copper alloys, which consisted of sodium dichromate, sodium nitrate, and sodium bisulfate. The rate of action of the bath could be closely controlled principally by controlling the temperature.

Plating

A large amount of effort went into the search for and development of baths that would produce a "bright" deposit, the reasons being the obvious elimination of some or possibly all of the buffing or coloring operations after plating. Platers have become so conscious of this trend that the first question asked upon the presentation of new bath formulae for any metal is, "Will it give a bright plate?" Another valuable property sought for in plating baths is the ability to "hide" surface defects and scratches in the base metal, which permits cutting down on the pre-plate polishing operations.

Polarity-reverse methods have been found to be particularly useful in this respect, and development of this method continued. *Jernstedt*[42] described the general benefits of the process, while *Chester*[43] was granted a patent for a pulsating current method for zinc. Specific developments in plating will be discussed under the appropriate metal in the following paragraphs.

Plating on Magnesium

One of the more significant developments of the year was the announcement of a process for successfully plating all metals on magnesium alloys by *DeLong*[44]. The process depends on a preliminary immersion coating of zinc from a pyrophosphate bath, followed by plating from conventional baths in the usual manner. A method for electrodepositing an adherent zinc coating on magnesium was patented by *Osborg*[45], while *Clark* and *Sheaffer*[46] obtained a patent on an immersion process for coating magnesium alloys with selenium.

Plating on Aluminum

Aluminum and its alloys are so frequently found in plating departments today that they are no longer classed as "visitors," and the wider adaption of the metal to many parts was very much in evidence during the past year. Successful methods for depositing adherent coatings have been in operation for some time, and further development of special techniques was evident. A patent was granted to *Julich* and *Mehmel*[47] for a method for direct silver plating of aluminum alloys which involved anodizing, alternating current treatment in weak phosphoric acid, then plating silver from a special cyanide bath. *Suchy*[48] patented a method for applying an immersion tin coating on aluminum, followed by a heat treatment at 500-600° C to produce a suitable surface for subsequent plating by the usual methods. Another immersion process for depositing a tin or copper-tin film on aluminum for subsequent plating was patented in England[49]. No heat treatment was claimed necessary for this latter process.

Aluminum Plating

Many attempts have been made to deposit aluminum on other metals electrolytically, but without commercial success. The drawback has always been the necessity for using non-aqueous baths or molten salt baths, both of which have practical disadvantages. Two more developments along these same lines should be reported, however. *Weir* and *Hurley*[50] obtained a patent on a toluene-aluminum chloride-ethyl pyridinium chloride bath, and *Weir*[51] patented a fused salt-bath electrolytic treatment using similar chemicals without the toluene. A special atmosphere is necessary over the first mentioned bath, which involves a further practical complication.

Alloy Plating

The ever increasing engineering use of electrodeposition as a method for producing surfaces with special properties has widened the search for techniques for depositing alloy compositions. Of special interest is the plating of oxidation and corrosion resistant alloys containing usually tungsten, and the plating of decorative metal combinations that are less

Soft-grit blasting scale and carbon deposits from aircraft cylinder heads. This method is finding wide use for cleaning soft metals.

costly than precious metal deposits. The first class of deposits will find wide use in the high temperature jet engines under current development, and several significant contributions to this field were made during 1948.

Clark and *Holt*[52] described a method for plating tungsten-cobalt combinations from citrate baths. Deposits of about 50% tungsten were obtained in a bright condition from a neutral (pH 7.0) solution. *Lietzke and Holt*[53] developed a bath for plating tungsten-iron alloys, tungsten-nickel alloys, and cobalt-tungsten alloys. Deposits again contained about 50% tungsten and were fairly bright as deposited. A patent was granted to *Holt* and *Black*[54] for a bath capable of producing iron-tungsten alloy deposits from an acid bath. The tungsten content of the deposit was much lower, around 10% by weight. *Holt* and *Nielsen*[55] obtained a patent for a nickel-tungsten alloy plating bath, giving a similar low-tungsten deposit.

Silman[56] described the use of lead-tin coatings for bearing surfaces to replace the more costly lead-indium deposits. The two deposits were produced separately, lead from a fluoborate bath and tin from a stannate bath, followed by a fusion heat treatment.

In the field of decorative alloy deposits, *Cuthbertson* and *Angles*[57] described a process for producing tin-zinc alloy deposits having good color, and corrosion resistance equal to or better than that of cadmium or zinc, plus better solderability than either cadmium or zinc. Bath conditions for various alloy compositions were described, and they concluded that a 78-22 tin-zinc ratio afforded the best protection for steel. Anodes of equivalent composition are used to maintain this metal ratio in the bath. The deposits are very ductile and can be readily buffed to a brilliant lustre.

A patent was granted to *Nachtman*[58] for an acid fluoride bath for depositing lead-tin alloys. Nicotine and beta-napthol were used as addition agents.

Cuthbertson[59] and *Sawyer*[60] described the commercial applications and properties of speculum (copper-tin) deposits. Optimum composition of the plate was at 45% tin, 55% copper, when deposits similar in appearance to silver and having high hardness, high reflectivity, and good resistance to tarnishing are produced. This lower tarnishing rate makes speculum deposits superior to silver over long periods of service, and the alloy is now being used on sealed automobile headlamp reflectors, spoons and forks, and other similar products not subjected to outdoor exposure.

Jernstedt[61] was granted a patent for a bath capable of depositing a bright silvery-colored alloy plate of 50-75% copper, 15-30% tin, and 5-20% zinc from a cyanide bath with addition agents. The deposit was claimed to be superior to nickel, tin, chrome, and silver in corrosion resistance, though not quite as reflective as silver. Good solderability was also claimed.

Lum and *Jernstedt*[62] patented a cyanide bath for producing silver-white deposits of copper-tin alloys, with or without zinc as a third constituent. Quaternary ammonium compounds were added to the bath for brighteners. Deposits of 55-60% copper, 25-28% tin, and 14-18% zinc are produced.

Chrome Plating

Both decorative and hard chrome applications increased during the past year, as evidenced by the use of more bright chrome trim on the "new-look" 1948 automobiles and the wider use of hard chrome on plastic molding dies, cutting tools, engine pistons and cylinders and shaft journal areas. A problem of importance in all chrome plating processes, the control and oxidation of trivalent chrome, was investigated by *Seegmiller* and *Lamb*[63].

Webersinn and *Hyner*[64] obtained a patent on a chrome plating and etching technique for producing "mud-crack" type surfaces of controlled size. *Passalacqua*[65] patented a heat treating method for improving the control of the above. Heat treating is performed on the chrome deposit prior to etching.

Copper Plating

The most important developments of the past year in copper plating were the increased use of either high-speed baths or bright baths, both utilized to help overcome the increased cost of mechanical buffing methods. The high-speed baths are now widely applied for plating heavy deposits on steel that can be buffed, or "flowed" to a high lustre before nickel plating, thus allowing for less preliminary surface preparation on inferior stock. In many plants certain parts are not given any wheel operations after copper plating, due to the use of bright copper, followed by bright nickel operations before chrome plating.

Willson, De Rose, and *Ellis*[66] reviewed the development and operation of the fluoborate high speed baths and studied the effects of sulfate additions (for lowered bath cost) on plating speed, limiting current densities, and tank corrosion. No beneficial effects were reported, limiting current densities for the mixed bath being lower than the straight fluoborate solution.

Improvement in the pyrophosphate bath for bright copper plating was made by *Stareck*[67], who obtained a patent on a nitrate addition to the pyrophosphate solu-

tion for improved stability up to the boiling point, greatly increased plating rate, and softer, more ductile deposit. The bath is suitable for barrel plating, striking, and plating on aluminum alloys and stainless steel. This new bath should see wide usage in electroforming due to its very high plating rate, and also as a stop-off plating for carburizing.

Indium Plating

Jones and *Bierly*[68] were granted a patent for an indium plating bath containing indium perchlorate as the principal ingredient. A unique method for making up the bath was claimed, substituting indium metal for copper in a copper perchlorate solution.

Dyer[69] also was granted a patent for an indium plating bath made up of 10-100 gm/l of indium hydroxide dissolved in formamide.

Lead Plating

Two baths for depositing lead were studied, neither of which produced satisfactory deposits for commercial plating. *Mathers* and *Griess*[70] worked with p-toluene sulfonate baths, and *Mathers* and *Suttle*[71] investigated ethylbenzenesulfonate electrolytes.

Nickel Plating

During the past year the bright nickel baths were more widely used than ever as a step towards lower finishing costs. The elimination of color buffing operations prior to chrome plating was an important saving in many finishing plants. While no new commercial baths were introduced during the year, a considerable amount of research was carried out on potentially useful processes. *Young* and *Roszkowski*[72] described an orthophosphate bath for nickel plating. Deposits showed good adhesion and buffability, and the throwing power of the bath was good. No addition agents were required.

An immersion process for depositing very thin films (.00003") of nickel on steel from acid chloride baths was presented by *Wesley* and *Copson*[73]. The deposits could be alloyed with the iron by suitable heat treatment, and could prove valuable as undercoatings for subsequent heavier deposits of other metals.

Several patents were granted for new nickel plating baths. *Du Rose*[74] patented an acid chloride-fluoride bath, where the fluoride acted substantially as a buffer, which claimed to give deposits of better ductility with better throwing power and freedom from pitting. *Smith*[75] obtained a patent for a bath and process utilizing pure nickel anodes. The bath was either of the all-chloride type or a mixed chloride-sulfate electrolyte, each containing formic acid. *Schweikher*[76] was granted a patent for a chloride-sulfate bath containing metasulfobenzaldehyde as an addition agent.

The effect of small amounts of copper as an impurity in nickel plating baths on the salt spray resistance of nickel and nickel chrome deposits was reported by *Ewing, Rominski,* and *King*[77]. In general copper was found to decrease the resistance to salt spray.

Palladium Plating

A cyanide bath for depositing palladium was patented by *Lambros*[78]. The bath was prepared by dissolving precipitated dichlorodiamine palladium in sodium cyanide solution.

Silver Plating

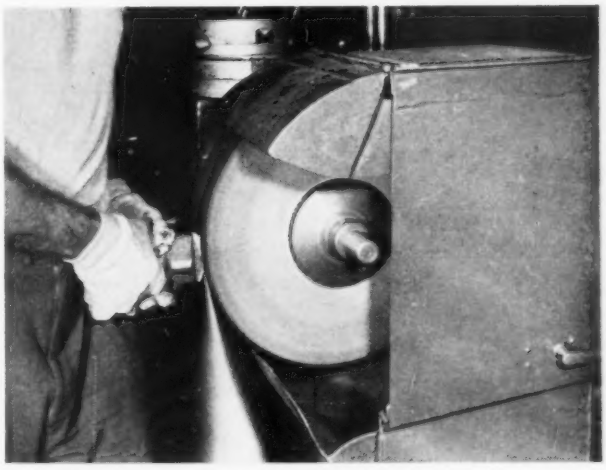
As in the case with other metals, considerable interest was shown in electrolytes that would produce bright deposits requiring no subsequent coloring. *Green*[79] obtained a patent for a cyanide bath containing a special brightening agent made up of ammonium thiosulfate, alkali sulfite, and acetic acid.

Levin[80] described experiments with cyanide-free electrolytes of silver iodides. Some interesting and potentially important observations were made, but no commercial application is yet possible with such baths.

The direct coating of steel with adherent silver was the subject of two patents. *Martz*[81] developed and patented a method for depositing silver from a cyanide bath over a previously formed phosphate film, and *Slatkin*[82] obtained a patent for direct coating of steel from a cyanide bath containing a small amount of chloride ion.

Tin Plating

In addition to the wider adoption of continuous plating of strip and wire in steel producing plants, several patents were granted for new baths. *Blackburn*[83] developed a method using sodium-tin anodes in an alkaline bath and operating at above 200 amps/ft^2. He also found that very high carbonate concentrations (15-30 oz/gal) were beneficial to anode current efficiency while maintaining good cathode current efficiency. *Harris*[84, 85] worked with acids baths, and found that additions of various agents such as phenolsulfonic acid, dihydroxydiphenylsulfone, and monobutylphenylphenal sodium monosulfonate, appreciably widened the plating conditions for obtaining satisfactory deposits.



Belt polishing methods are showing substantial savings in the polishing of metal parts, especially for heavy grinds on the harder metals.

Zinc Plating

With the price of cadmium remaining around $2.00 per pound, many parts formerly cadmium plated were changed to zinc, and the pros and cons of the value of each raged on. With the present bright dips and passivating treatments available, very attractive and protective zinc coatings are possible.

Two important bath patents were issued. One, to *Prust*[86], was for an acid chloride bath containing small amounts of alkali fluorides and alkaline earth chlorides. The second was issued to *International Corrodeless, Ltd.*[87] for sodium chloride additions to bright alkaline baths to promote finer grain and increase throwing power and efficiency.

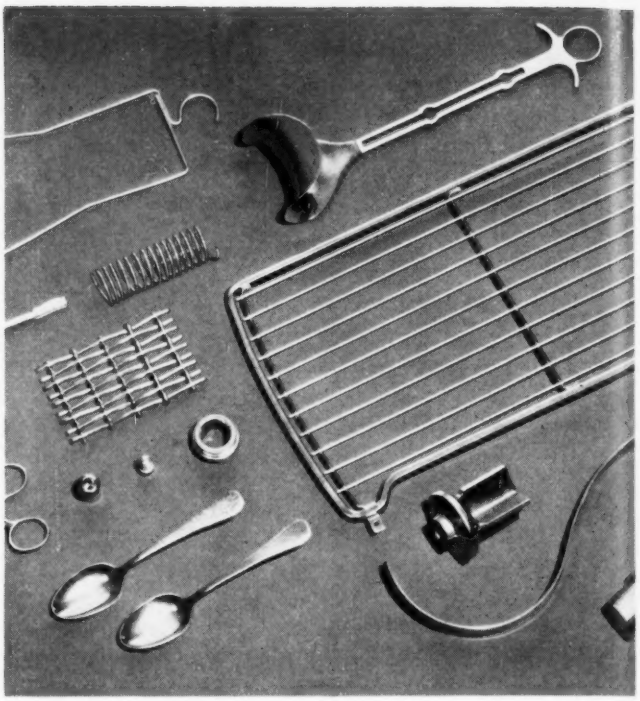
Bath Purification Methods

In recognition of the profound effect of very small concentrations of impurities or foreign metal ions on the deposition process, several important contributions to bath purification processes were made during the past year. The trend to incorporate continuous filtration and electrolytic purification with bright nickel installations continued.

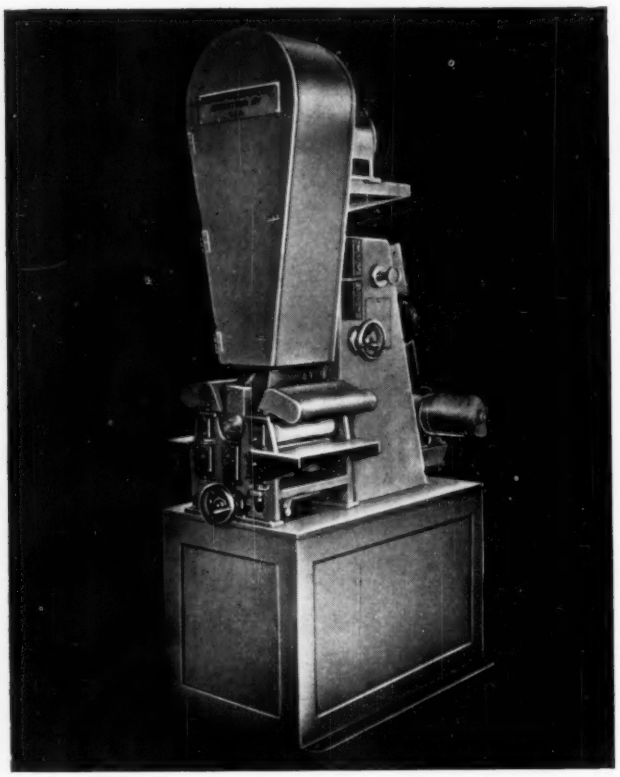
Carter[88] reported on the low current density removal of zinc from bright nickel baths of the cobalt-nickel types, determining rate of removal of zinc under various electrolyzing conditions.

Cyanide bath purification also came in for some investigation, *Chester*[89] obtaining a patent for controlling the carbonate content of various baths with calcium gluconate suspended in the bath to precipitate calcium carbonate. *Ross*[90] reported a new method for precipitating carbonates with calcium carbide which left the other bath constituents except caustic soda virtually unchanged. The caustic soda content is increased by about ¾ oz/gal for each oz/gal of carbonate removed.

Benner and *Bair*[91] were granted a patent for a process of removing organic impurities from alkaline baths by precipitating them as magnesium carbonate.



A typical group of parts that have been electropolished. Complicated shapes such as these would be difficult to polish by conventional methods.



A newly developed machine for automatically polishing strip metals. Such equipment materially reduces finishing costs, and many special types are available for production work.

Surface Treatments

In the field of surface treatments other than electrodeposited metallic coatings, a wide range of activity was in evidence during the past year. Anodizing and phosphating, two of the old stand-bys in the surface treatment picture, were the subjects of several interesting developments, as will be shown later. The wider uses of metallic coatings on plastics was very much in evidence, and these applications should see greater popularity because of the extensive range of decorative effects possible.

Metallic Coatings on Metals

For special engineering applications, the preparation of a metal coating on a metallic part which is subsequently heat treated to cause the formation of alloy surface layers having unique properties is gaining in importance. For chromium surfacing, the two mechanisms (deposition and fusion) are carried out in a single operation, as described by *Black and Rosen*[92], giving an alloy surface on steel or iron articles that has outstanding corrosion and galling resistance, even at elevated temperatures.

A patent was granted to *Marshall*[93] for an apparatus and method for continuous coating of steel strip with aluminum from a molten bath, similar to galvanizing.

Such aluminum-coated steel could open up a wide field for dye-colored finishes on a ferrous base metal, utilizing present chemical or anodic processes.

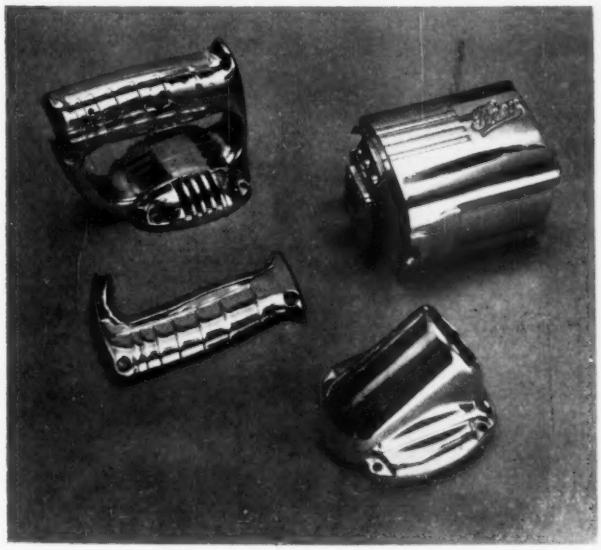
A method was patented by *Schweiker*[94] for forming adherent, black, corrosion-resistant coatings of lead oxide on iron articles by anodizing in a lead sulfamate bath.

Current plating practice for aluminum alloys generally starts with a primary coating of zinc, upon which the other metals can then be deposited. A British patent[95] involving the immersion deposition of tin films for the same purpose was granted this year. An interesting feature of this tin deposit is claimed to be the possibility of stripping electroplated coatings applied over the tin without affecting the removal of the tin layer itself.

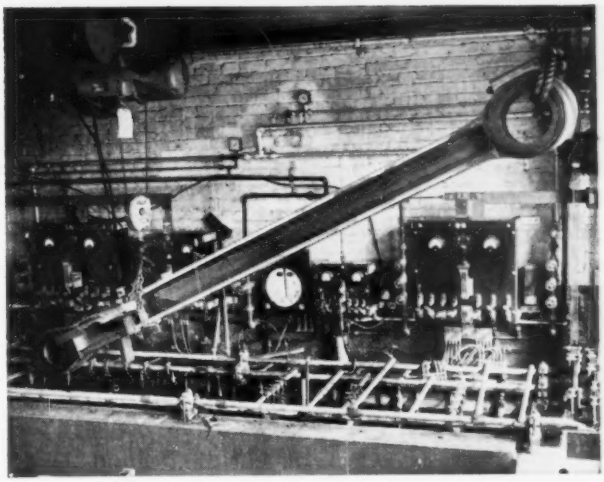
A method for the rapid deposition of metals by decomposition of their carbonyls was announced as being a practical reality[96]. Nickel, iron, chromium, tungsten, and molybdenum deposits are possible, and at extremely fast deposition rates. The temperatures used are in the neighborhood of 400° F, and the process promises to be of considerable importance in electroforming.

A new process for continuous galvanizing of sheet and wire which required no prior pickling was being introduced in France[97]. Cleaning was done by passing the material through a heated cracked-ammonia chamber, then directly into the molten zinc zath. Besides eliminating operating difficulties due to fluxes, the process is claimed to be economical of heat and pots, as the entering hot material maintains the galvanizing heat without any heat being applied to the pot itself, thus prolonging the pot life.

The deposition of rarer metals saw some development, with *Clark and Sheaffer*[98] being granted a patent for depositing immersion selenium films on magnesium alloys for protective purposes. A process for depositing tantalum and columbium from their volatile chloride was described by *Powell, Campbell,* and *Gonser*[99]. Heavy deposits up to .030". were obtained on copper, iron, and ceramics in about 100 minutes.



A group of chromium-plated magnesium alloy parts. This combination will prove valuable where attractiveness must be combined with lightness.



A railway plant set-up for hard chrome plating the journal areas of locomotive main rod. Longer life and greater safety are thus brought to many such critical and expensive parts.

Chemical Coloring

Chemical coloring methods continued to show wide application, with the black finishes regaining some of the ground lost at the end of the war. A good part of the "art" of metal coloring has been eliminated by the wider use of easily controlled proprietary mixtures, especially in the black finishes. *Coppins*[100] described a modified molybdate method for blackening zinc-base alloys, and baths for coloring copper alloys are now almost as numerous as there are parts being treated. The increased use of aluminum during the past year has also increased the use of chemical coloring treatments for these alloys.

Anodizing

Although the process of anodizing is widely used commercially, fundamental knowledge of the mechanism of the formation of the film and its properties is still subject to considerable debate. *Mason* and *Slunder*[101] studied the formation of these oxide films in both sulfuric and oxalic acid baths, and concluded that high temperature baths and concentrated baths produced lighter weight coatings, as does lowered current densities. They also found that high purity aluminum produced highest efficiency in the anodizing process.

Burwell and *May*[102] measured the permeability of anodic films, and found that films of equal thickness from both the chromic acid and sulfuric acid electrolytes had about the same permeability. Exposure of the anodized film to the electrolyte after completion of the anodizing cycle increased the permeability, while sealing treatments caused a hundred-fold decrease in the films' permeability.

A British patent[103] was granted for an anodizing process using a sulfuric-hydrochloric acid electrolyte, which was claimed to produce films of adequate thickness in a much shorter time (½-2 mins), and films that were exceptionally flexible and susceptible to dye treat-

ments. Higher voltage breakdown resistance was also claimed.

A study of various sealing treatments for anodized coatings was made by *Whitby*[104], who concluded that chromate sealants gave the best results, even better than nickel or cobalt acetate treatments.

Schulein[105] was granted a patent for regenerating anodizing baths by precipitating accumulated aluminum with alkaline agents at a pH above 3, then electrolyzing the filtrate to reduce the pH to its normal value.

An interesting development in the use of anodized aluminum was the granting of a patent to *Mack*[106] for anodized aluminum razor blades. Next we'll probably find them being dyed black to match early morning shaving moods!

A method for anodizing magnesium alloys was described by *Kohl* and *Waterman*[107]. A hot, saturated solution of sodium carbonate is used at about 110-120 volts D.C. The film formed was claimed to be harder than similar anodized coatings on aluminum alloys, and offered better corrosion resistance than the acid dichromate treatment.

A method for re-activating anodized coatings on aluminum for dyeing was patented by the *British Alum. Co.*[108]. It was claimed to be of value in treating parts which had been stored for periods up to several weeks between the anodizing and dye-coloring treatments.

Phosphate Coatings

With the return to emphasis on high quality organic finishes, wider application of phosphate coatings, especially of the spray-types was noted during the year. Other important applications, such as for lubricating on heavy wire drawing and deep drawing jobs, also increased.

Streicker[109] studied the mechanism of the phosphoric acid-steel surface reaction, and *Streicker* and *Murphy*[110] reported on the importance of maintaining the correct acid ratio in the phosphating baths.

A patent was granted to *Lum*[111] for a zinc and cadmium phosphating bath, and a method for maintaining the correct ratio of dissolved iron in the bath by electrolytic action. A British patent was obtained by *Pyrene, Ltd.* which proposed the use of ammonium nitrate instead of sodium nitrate as an accelerator to control the formation of sludge in the processing tank.

A typical application of electroplating for functional properties. Pump parts heavy nickel plated for corrosion and wear resistance in handling acidic materials.

Protective Films

An important new development in this field was the announcement of the valuable protective qualities of protein films. The films may be used on nearly all metals, and are applied by a simple immersion in casein, albumin, or gelatin solutions followed by an immersion impregnation in a chromate solution. The films, in addition to providing corrosion resistance over fairly long periods of time, may be readily removed in a warm solution of soda ash.

Testing—Solution Control

One of the most encouraging trends in the past few years has been the almost universal acceptance of analytical control as an important accessory in plating work, even in the smallest types of operating plants. Such widespread use of analysis is due to and dependent upon rapid, accurate methods. During the past year increased use of colorimetric methods was noted, especially for the determination of small quantities of impurities such as in the critical bright nickel baths. The American Electroplaters Society has continued its research program on this subject, and during the past year reported on methods for Silica[112], Potassium and Sodium[113], Aluminum[114], and Cadmium[115] in bright nickel solutions. A colorimetric method for gold was reported by *McBryde* and *Yoe*[116], and a rapid volumetric mehtod for p-toluenesulfonamide in bright nickel solutions was presented by *Sirota*[117].

A method for determining sulfides in bright zinc baths was reported by *Anisimov* and *Intson*[118], and a test paper for rapid checking of this constituent was made available to platers[119].

Along with increased dependence on chemical control of plating baths, the wider use of "plating cell" methods of control was apparent. In addition to the familiar Hull Cell, other special cells for unusual problems were the subject of a report by *Mohler*[120].

Testing of Deposits

The search for rapid, non-destructive methods for evaluating the properties of electrodeposited coatings continued, and several important contributions were made by various investigators during the past year.

Thickness

An instrument for measuring the individual thickness of composite copper-nickel coatings was developed by *Brenner* and *Kellogg*[121]. This instrument is a modified form of the Magnegage, and utilizes two magnets of different strengths. Accuracies of about 10-15% are possible in the range of .0005"-.0030". *Francis*[122] described an electrolytic thickness tester which used the current-time product as a measure of the coating thickness. A definite area of the specimen was made anodic under a constant current until the coating was dissolved. Very high accuracy was claimed, in the order of ±2%, and the method was applied to practi-

cally all metals, including non-magnetic coatings on non-magnetic base metals.

A patent[123] was granted for a thickness testing probe which could be immersed directly into the plating bath to measure thicknesses of coatings without removing the part from the tank or disconnecting the current.

The effect on the jet method for thickness determination of the residual stress in electrodeposits was investigated by *Read* and *Thompson*[124], who found that high stresses reduced the apparent thickness, while annealing raised the apparent thickness as determined by the jet methods. Deviations up to 5% were noted.

Adhesion

Present methods of adhesion testing are admittedly inadequate for the average deposit, and new methods are under investigation by a project group of the A.E.S. A progress report on the use of cements was made by *Ferguson* and *Tsao*[125], but the method developed did not prove entirely practical, and further research is progressing on this and other methods.

Porosity

Another of the research projects of the A.E.S.[126] reported on a method for measuring the porosity of metal by measuring the rate of permeation of a non-corroding gas under pressure thru the deposit separated from the base metal. While this test is not of the practical type, it can provide basic information on porosity for research purposes.

Stress

The relation of internal stress to the observed physical properties has been in the past a matter of opinion based on general observations only, due to the lack of an accurate method for determining the extent of the stress. A major step in overcoming the latter problem was made by *Brenner* and *Senderoff*[127] with their development of the spiral contractometer for measuring stresses in deposits.

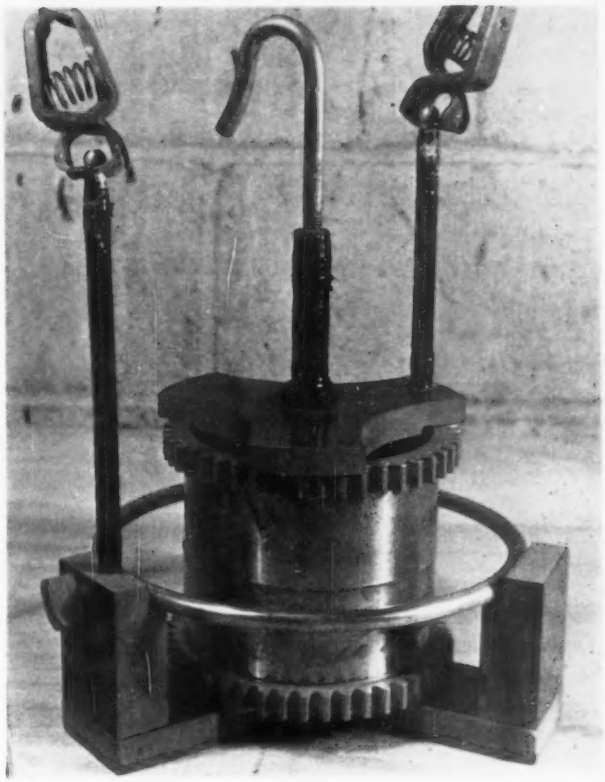
Graham and *Lloyd*[128] studied the amount of stress produced in copper deposits from cyanide baths, and found that stresses ranged from expansive stresses of 5,000 psi to contractile stresses as high as 15,000 psi. The effect of various addition agents and operating conditions was also reported.

Hardness

A simple microhardness tester suitable for testing electrodeposits was described by *Bergsman*[129], who listed Vickers hardness numbers of 1,000 for chrome plate and 73 for zinc plate as illustrative of the range of the instrument.

Brightness

The increased use of bright plating baths has caused a need for an accurate method for measuring the "brightness" of various deposits. A new contribution to this field was made by *Ollard*[130] in the form of a shop-type instrument suitable for routine testing.



A special set-up for lead-indium plating the bearing areas of a critical aircraft part. Rigid specifications insure quality plating in this industry.

Corrosion Testing

A method for evaluating in a more systematic manner the progress of rusting of steel test specimens was proposed by *Faigen*[131]. This system takes into account the number, size, and type of rust spots, and condenses this information into a short numerical rating, thus doing away with lengthy descriptions and photographic proofs.

Special Corrosion Preventive Methods

One of the constant problems attending the manufacture of decorative plated items is the maintenance of the high quality finishes during storage, stocking, and shipment. Several new techniques to help overcome this problem were announced recently. *Stroud* and *Vernon*[132] obtained a patent for the use of volatile benzoates, such as n-propyl benzoate and n-butyl benzoate, either in the form of an impregnated wrapping paper or as a separate substance introduced into the package, to inhibit corrosion. A similar application using materials containing soluble nitrites was patented by the *Shell Development Corp.*[133] With this material, a pH of over 6 must be maintained in order for the material to be effective. A third patent was granted to *Frankenhoff*[134] for the use of formaldebyde in packaging materials to prevent corrosion.

(*References on page* 99)

Throwing Power of Electroplating Solutions—Part II

By A. Mankowich, *Darlington, Maryland*

Introduction

IN A recent publication[1] various methods that have been proposed for evaluating and/or defining throwing power of electroplating solutions were described. No discussion of the factors affecting this property was included, although they were enumerated; namely, (a) change of cathode potential with current density, (b) change of cathode current efficiency with current density, (c) solution resistivity, and (d) primary current distribution. In this paper it was decided to present a brief discussion of the basic principles of throwing power; and to indicate that while the Haring and Blum formula is expressed in empirical terms, its validity has been substantiated by the agreement of its numerical values with those calculated from cathode single potentials, solution resistivities and current efficiencies.

Derivation of Formulae

Let us consider a Haring Cell such that,

D_f = distance from far cathode to anode.
D_n = distance from near cathode to anode.
R_f = solution resistance from far cathode to anode.
R_n = solution resistance from near cathode to anode.
I_f = current density on far cathode.
I_n = current density on near cathode.
F_f = cathode current efficiency at I_f.
F_n = cathode current efficiency at I_n.
e_f = cathode single potential on far cathode at I_f.
e_n = cathode single potential on near cathode at I_n.
a_a = anode potential.
E_f = Resistance drop thru solution, far cathode to anode.
E_n = Resistance drop thru solution, near cathode to anode.
m_f = Weight of metal deposited on far cathode.
m_n = Weight of metal deposited on near cathode.

$K = \frac{D_f}{D_n} = \frac{R_f}{R_n}$ = primary current distribution ratio.

$M = \frac{m_n}{m_f}$ = metal distribution ratio.

Now, since the voltages between the anode and the far and near cathodes are equal.

$$a_a + E_n - e_n = a_a + E_f - e_f$$
$$E_n - e_n = E_f - e_f$$
$$I_n R_n - e_n = I_f K R_n - e_f$$
$$\frac{I_n}{I_f} = K - \frac{e_f - e_n}{I_f R_n}$$

and, $\frac{I_n}{I_f} = K\left(1 - \frac{e_f - e_n}{E_f}\right)$ *secondary current ratio.*

Now, $$M = \frac{m_n}{m_f} = \frac{I_n f_n}{I_f F_f} = \left(\frac{I_n}{I_f}\right)\frac{F_n}{F_f} \quad (1)$$

And since, Throwing Power $= 100 \times \frac{K-M}{K}$ (2)

Hence, Throwing Power =

$$100\left[1 - \frac{F_n}{F_f}\left(1 - \frac{e_f - e_n}{E_f}\right)\right] \quad (3)$$

Or, Throwing Power =

$$100\left[1 - \frac{F_n}{F_f}\left[\left(1 - \frac{e_f - e_n}{I_f K R_n}\right)\right]\right] \quad (4)$$

Equations (1), (3), and (4), for the developments of which we are indebted to *Haring and Blum*[2], show clearly the significant factors and the manner in which they influence throwing power. It is to be noted that throwing powers calculated from equations (3) and (4) agree within experimental error with values obtained from equation (2), the customary expression expressed in empirical terms. The values of the several factors required in equations (3) and (4) may be obtained in the Haring Cell[2].

Discussion of Factors

Current Efficiency

Equation (1) for metal distribution ratio indicates that throwing power can be increased by a decrease in cathode current efficiency at the higher current density (near cathode), or by an increase in

current efficiency at the lower current density (far cathode). Either of these changes will tend to decrease the value of "M," which results in an increase in throwing power, as is apparent from equation (2). In this connection, it has been shown experimentally that nickel plating solutions with low current efficiency at low current densities possess poor throwing power, while improved throwing power is obtained in solutions showing higher current efficiency at low current densities[3]. In general, solutions exhibiting increased current efficiency with increase of current density will have poor throwing power.

Solution Resistivity

From equation (4) it can be predicted that a decrease in solution resistivity (increase in conductivity) will result in improved throwing power, provided the influence of the other factors remain the same. Solution resistivity can be decreased usually by increasing the temperature or by the addition of more electrolyte. Either of these changes, however, may have appreciable influence on the cathode potential, and thus nullify the effect on solution resistivity.

Cathode Single Potential

Equations (3) and (4) indicate that the greater the difference between the single potentials of the far and near cathodes, the better the throwing power. This is equivalent to stating that the greater the slope of the cathode potential—current density curve, the better the throwing power.

Closing Remarks

Haring and Blum were the first investigators to develop equations (1), (3) and (4), by means of which it is possible to calculate throwing power in terms of its generally-recognized basic factors, change of current efficiency and cathode potential with current density and solution resistivity. It is not so well known that these authors presented the development of these equations in the original paper[2] in which their more well known equation (2) was proposed. Equation (2) expresses throwing power empirically in terms of the primary current distribution and metal distribution ratios. It is significant that numerical values of throwing power computed from equation (2) agree closely with values obtained from equations (3) and (4).

The preceding work appears to have been overlooked by some investigators. A paper by *Gardam*[4] parallels substantially the Haring and Blum derivation of the secondary current ratio. Then, instead of making use of the relatively simple $\frac{e_f - e_n}{I_f}$ term in the equation for throwing power, an unnecessary and laborious process is initiated to obtain a mathematical relationship for the cathode potential—current density curve. Different types of equations are necessary, depending upon the plating solution, as some solutions have a linear relationship and others a logarithmic one. When the constants of the appropriate curve are obtained, an expression called "throwing number" may be calculated. Subsequent substitution of the "throwing number" in the throwing power equation (Field's modification) gives values that often are not in substantial agreement with observed values. The "throwing number" procedure for evaluating throwing power thus appears to have little practical usefulness. This method is actually based on Haring and Blum's derivation of the secondary current distribution ratio, and its only novelty is the unnecessary and laborious process of determining the equation for the cathode potential-current density curve.

Bibliography

1. *Mankowich*, Metal Finishing, July, 1948.
2. *Haring and Blum*, Trans. Electrochem. Soc., Preprint 28, 1923.
3. *Flowers and Warner*, Trans. Electrochem. Soc., Preprint 62-29, 1932.
4. *G. Gardam*, Trans. Faraday Soc., No. 206, Vol. 34, Part 6, June, 1938.

Comment on Mr. Mankowich's Article on "Throwing Power" by Dr. Geo. E. Gardam

In any consideration of throwing power, one must not lose sight of the ultimate significance of this conception. Simply stated this is as follows: On an irregular article the "primary current distribution" is determined by the shape of the article and by the distance and position of the anodes. This primary current distribution can theoretically be calculated, although, as shown by *Kasper*, the difficulties are considerable. In actual electro-deposition of metal, the "throwing power" of the solution makes the deposit more (or less) uniform than would be expected from the primary current distribution. *Haring & Blum's* masterly and enduring work on the standardization and rationalization of a quantitative test for throwing power then allows one in the practical case to predict *qualitatively*, and only qualitatively, this increased uniformity and the effect of the various factors such as resistivity, current density/current efficiency and current density/cathode potential relationships. This arises because even if the primary current distribution is known the other terms of Haring & Blum's equation (e.g. 3 or 4) are not known. Indeed the expression of the primary current distribution as a simple ratio of distances from the anode to the near and far points is incorrect in the practical case since some of the path is common.

A good example of this problem is the case of a two inch hemispherical cup. In a paper in *Proc. Amer. Electroplaters. Soc. Ann. Conv.* 1939, *p.* 16, I gave the thickness of deposit at the center inside and out when the cups were plated under various conditions. Although the primary current distribution was known I do not think anyone could have calculated the results, although they could have been forecast in a general sort of way.

(*Concluded on page* 67)

pH—Its Meaning and Determination—Part I

By Howard Sanders, *Calco Chemical Division of American Cyanamid Co., Bound Brook, N. J.*

Introduction

MEDICAL men know that bacteria, yeasts, and other microorganisms simply will not grow unless their environments are carefully adjusted to the proper pH. Manufacturers of hard candy know that excessive acidity in glucose results in an objectionably sticky product. Leather manufacturers, realizing full well the critical role played by pH control, have applied hydrogen-ion measurements to every process involved in the manufacture of leather, from the first conditioning of the raw skins to the final tanning of the hides. Whether the job be textiles, soils, paper, food, water treatment, the polymerization of chemical rubber, or the electrodeposition of metals, pH is today one of the most powerful weapons for process control in the hands of trained operators.

The Author

Mr. Howard Sanders has been associated with the Calco Chemical Division of the American Cyanamid Company for a year and a half, and is engaged in process development work in the coal-tar products section. A chemical engineering graduate of Cornell University, he has written several technical articles to date. Last year he received an award from the American Welding Society for a paper on underwater welding.

Proper pH control results directly in increased production, reduced costs, and a minimum of two of the knottiest production problems of all, corrosion and maintenance. In many of its applications, accurate pH control is at least as vital as the accurate control of temperature or pressure. Particularly in the field of metal plating, pH is one of the most significant factors determining the quality and uniformity of the product.

So rapid has been its application throughout the industry that a great number of routine workers now using pH in their daily work still have no understanding of its meaning or underlying principles. Laboratory and plant personnel may be glib in discussing pH but many still do not know even the fundamentals upon which are based the techniques used in measuring hydrogen-ion concentration.

The purpose of this discussion is to eliminate these obvious deficiencies by exploring in detail the meaning of pH and the colorimetric methods available for its measurement. An exploration of the electrometric methods of analysis and a consideration of the special pH problems involved in the electrodeposition of metals will be reserved for a later article.

The Meaning of pH

Acids range from the strength of sulfuric acid, which can readily "eat" a hole through iron plate, to the mildness of boric acid, which is perfectly safe even when in contact with so delicate a mechanism as the human eye. The difference in activity between these two is solely a function of their "pH", or hydrogen-ion concentration.

In the past, the acidity of a solution was considered by many only in terms of its effect upon litmus paper: a solution was acid if it turned blue litmus to red. The *degree* of the solution's acidity received very little attention. For others, the acidity of a solution was found in measuring the amount of alkali re-

quired to bring the solution to "neutrality". Although this latter technique was capable of determining the *total* amount of acid present, it did not directly indicate the solution's hydrogen-ion concentration, which determines its relative activity. Solutions of 0.1 normal* hydrochloric, acetic, and boric acids, although they are of equal concentration as determined by neutralizing with standard alkali, actually have widely different hydrogen-ion concentrations, and consequently widely different degrees of activity. Their "pH" values are 1.0, 2.9, and 5.2 respectively. The *intensity* of acidity of each of these acids is roughly in the proportions of 15,000 : 200 : 1. Clearly enough, the *effective strength* of an acid cannot be found directly by titrating for the total amount of acid present.

The pH scale, used as the basis for specifying the hydrogen-ion concentration of a solution, is fundamentally rooted in the electrolytic dissociation theory set forth by *Arrenius* in 1887. It pre-supposes that when an acid or alkali is dissolved in water it dissociates or breaks down into its component ions, which are nothing more than atoms or groups of atoms carrying an electrical charge. The strength of an acid is determined not by the amount of acid present but by the extent to which it liberates free, positively-charged hydrogen-ions (H^+). Conversely, the strength of a base is measured by the extent to which it liberates free, negatively-charged hydroxyl ions (OH^-). Strong acids and bases are almost entirely dissociated into ions, while weak acids and bases dissociate only slightly. This fact alone accounts for their characteristic acidic or alkaline behavior.

The following table gives the approximate pH values of various acids and bases, all of equal normality. If it were possible to dissociate completely the acids and bases, all the acids would yield an equal number of hydrogen ions while all the bases would yield the same number of hydroxyl ions. The pH values of the various acids and bases are different because of the varying degrees of dissociation actually observed.

TABLE I

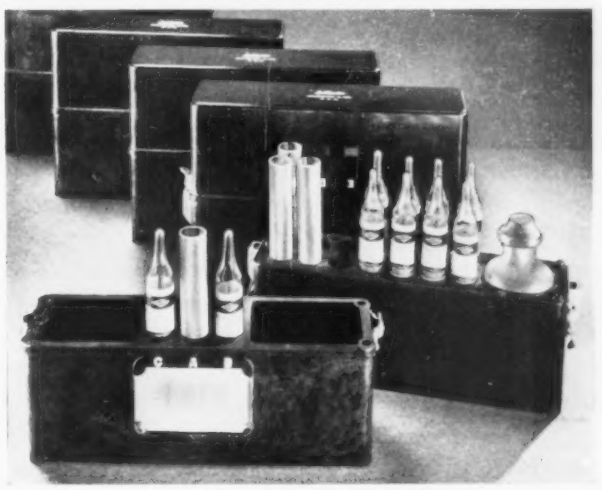
pH of Tenth-Normal Solutions of Various Acids and Bases.

Acids	*pH*	*Bases*	*pH*
Hydrochloric	1.0	Sodium Bicarbonate	8.4
Sulfuric	1.2	Borax	9.2
Acetic	2.9	Ammonia	11.1
Carbonic	3.8	Calcium hydroxide	12.3
Boric	5.2	Sodium hydroxide	13.0

The use of the pH scale vastly simplifies any consideration of hydrogen-ion concentrations. The difficulty originally encountered stemmed from the fact that the quantities involved are very small. For instance, in pure water only one molecule in about 555 million is actually dissociated. A plating bath may be only 0.000,000,05 normal. This figure is obviously difficult to handle. Moreover, it is cumbersome to compare this concentration with the acidity of stronger or weaker solutions. Of course, the same figure may be written as 5×10^{-8}, but even this is not altogether convenient.

In 1902, *S. P. Sörenson*, realizing the need for a simple method for designating acidity, suggested the pH system, based on the relation of the hydrogen and hydroxyl ions in pure water. According to one of the important laws of physical chemistry known as the Law of Mass Action, the product of the hydrogen and the hydroxyl-ion concentrations in pure water is equal to a constant, which under ordinary conditions is equal to 10^{-14} gram-equivalents per liter. However, because pure water is neutral in reaction, this means that there must be an equal number of hydrogen and hydroxyl ions, or 10^{-7} gram-equivalents of each per liter, since $10^{-7} \times 10^{-7} = 10^{-14}$. If an acidic material is now added to the pure water, the number of hydrogen ions increases to some value such as 10^{-5} or 10^{-3} (the lower the negative exponent the higher the value) while the hydroxyl ions decreases to 10^{-9} and 10^{-11} respectively, the product of the two ion concentrations always equalling 10^{-14}.

Sörenson designated the pH of a solution as the negative logarithm of the hydrogen-ion concentration, with a pH of 7 being the neutral condition. (The negative logarithm of 10^{-7} is 7; of 10^{-4} is 4; of 10^{-9} is 9; etc. It will be noted that if the minus sign in front of the exponent is ignored, the pH is equal to the exponent of the factor 10). Thus, solutions having more hydrogen (acid) ions than pure water would have pH values less than 7, while solutions having more hydroxyl (basic) ions than pure water would have pH values greater than 7. He further defined the entire pH scale as extending from a pH of 0 to a pH of 14. The standard for a pH of 0 at the acid end of the scale was taken as the hydrogen-ion con-



(Photo courtesy LaMotte Chemical Co.)

Figure 1—Set of pH color standards using a single indicator to cover a limited range of pH.

* Normal solutions of all acids contain the same *weight* of hydrogen atoms.

centration in a normal solution of hydrochloric acid (36.5 gm./liter of HCl), and the standard for the basic end of the scale at a pH of 14 was a normal solution of sodium hydroxide (40 gms./liter of NaOH). It is quite possible, of course, to have solutions with a pH less than 0 by this system, and basic solutions having a pH higher than 14, but these are far from common in electroplating work since the extent to which a material will form ions greatly decreases as its concentration in a solution increases.

It is well to mention at this point two oft-confused characteristics of the pH scale. The scale is so arranged that the lower the pH the higher is the hydrogen-ion concentration. Furthermore, the scale is not arithmetic. When a solution is brought from pH 5 to pH 6, the decrease in hydrogen-ion concentration is ten times the decrease in hydrogen-ion concentration when the solution is brought from pH 6 to pH 7. A solution with pH 5 contains 100 times as many hydrogen ions as one with pH 7. A solution with pH 4 contains 1,000 times as many hydrogen ions as a solution of pH 7.

In an alkaline solution, the hydroxyl ions predominate, but hydrogen ions are nevertheless present also. If a solution becomes increasingly basic, the concentration of hydrogen ions decreases proportionately. Therefore, a measure of the hydrogen-ion concentration of an alkaline solution is also an indication of its basicity or hydroxyl-ion concentration.

A "pOH" scale is therefore unnecessary since the sum of the "pOH" and the pH of a solution is always constant an dequal to 14. Since the "pOH" values bear a fixed relation to pH, two scales of reference are unnecessary. Values of pH serve, therefore, to specify the alkalinity as well as the acidity of a given solution. In a 0.1 normal sodium hydroxide solution, the hydroxyl-ion concentration is 1×10^{-1}. The "pOH" equals 1. The pH equals 14 minus 1 or 13.

Aside from the fact that the pH scale simplifies the discussion of hydrogen-ion concentration, it also simplifies the graphing of experimental data. Effectively, all data points are placed on a logarithmic rather than an arithmetic scale. On a standard arithhmetic scale, it is obviously impossible to represent in a compact and accurate fashion such widely dissimilar hydrogen-ion concentrations as 1×10^{-1} and 1×10^{-9}. But when the pH values of 1 and 9 are used, the plotting of data points is simple and strictly according to arithmetic convention. Scales other than Sörenson's for indicating hydrogen-ion concentrations have been suggested. These have the virtue of denoting increasing hydrogen-ion concentrations by increasing numerical values. Despite the obvious advantage of simplified visualization, the proposed scales would find extreme difficulty in displacing the present pH scale, which has become so solidly established by almost universal usage.

(Photo courtesy Kocour Co.)

Figure 2—pH color standards in comparator block.

The Measurement of pH

Colorimetric Method

The simplest method of measuring pH is by colorimetric methods. Colorimetric techniques are based upon the assumption that when equal quantities of an indicator are added to equal volumes of solutions of the same pH, the indicator will assume the identical color. Within the range of accuracy normally required, this assumption is valid.

The red color imparted to blue litmus paper by an acid falls under the colorimetric heading, although litmus is one of the least accurate of the color indicators available. More specifically, litmus is a special type of color indicator known as a neutralization indicator. It changes in color approximately at the borderline between acidity and basicity. The indicator is capable of existing in two distinct chemical forms each having a different color, one of which predominates in acid solution while the other predominates in alkaline solution. The actual color shown by the indicator depends upon the ratio of the two forms, this ratio varying directly with the pH of the solution. The change from a predominately acid color to a predominantly alkaline color of a neutralization indicator takes place close to pH 7 and within a short pH interval, usually about two units. With the general run of pH indicators, however, the position of this color-change interval in the scale of the pH varies widely with different indicators. Within the interval, it is possible to select a desired color which corresponds closely to a known pH value.

In many practical operations, the colorimetric method is as precise as any technique need be. It has the decided advantage of convenience, simplicity, and low cost. In routine plant and laboratory work, it is seldom necessary to know the exact pH of a solution, but rather the narrow range of pH over which an operation may be conducted most successfully. This information can readily be obtained, provided the proper indicator is employed.

Of the 1,400 different colorimetric indicators available, the following are a few of the most common:

Indicator Name	*pH Range*	*Color Change*
Acid cresol red	0.2- 1.8	red to yellow
Thymol blue	1.2- 2.8	red to yellow
Benzo yellow	2.4- 4.0	red to yellow
Methyl orange	3.1- 4.4	red to orange-yellow
Congo red	3.0- 5.2	blue-violet to red
Methyl red	4.2- 6.3	red to yellow
Paranitrophenol	5.0- 7.0	colorless to yellow
Phenol red	6.8- 8.4	yellow to red
Cresol red	7.2- 8.8	yellow to red
Phenolphthalien	8.2-10.0	colorless to red
Thymolphthalein	9.3-10.5	colorless to blue
Acyl blue	12.0-13.6	red to blue

When testing a solution of unknown pH, the first step is to determine whether it is acid, neutral, or alkaline. For this purpose, brom thymol blue is often specified. Covering the pH range of from 6.0 to 7.6, it turns yellow if in acid solution, greenish blue if in neutral solution, and deep blue if in alkaline solution. If a deep blue test is obtained, it is evident that only the basic indicators need be used to determine the pH of the solution more exactly. The next reagent to be used in this case would be a color indicator covering the pH range closest to brom thymol blue on the alkaline side, namely phenol red, which covers pH 6.8 to 8.4. This technique, without the further use of precise color standards, is capable of determining pH within approximately 1 pH unit.

Color Standards

Color standards of pH are often used where still closer control of hydrogen-ion concentration is required. The color standards for a particular indicator consist of a series of solutions of precisely known pH, plus added indicators, arranged in sealed tubes. Figures I and II show two types of available equipment. The pH values of the samples differ in intervals of 0.2 pH units ordinarily. To each solution there has already been added an equal amount of the indicator, which assumes its characteristic color at that pH. When the same indicator is added to the unknown solutions, its color may be compared with the test solutions. Of course, the same volume of unknown and indicator solutions must be used as were originally employed in formulating the color standards or else dilution effects will introduce undesired complications. As the intensity of the color is visually judged by examining the color of light transmitted through the solutions, test tubes of the same bore and thickness as those of the standards should obviously be employed in testing the unknowns, to insure that equal depths of standard and unknown solution are being viewed. The appropriate indicator is chosen only after a preliminary test with a mixed indicator to determine very approximately the pH of the solution. By properly matching the color of the test sample it is possible to designate the pH of the unknown to within 0.05 to 0.1 pH units.

(*Photo courtesy R. P. Cargille Co.*)

Figure 3—pH test papers.

The use of color standards is simplest when the unknown is absolutely clear and colorless. Since the standards are formulated using colorless buffer solutions, the color of the standards will then only be that of the indicator. In actual practice, however, most determinations are made on solutions that are either colored, turbid, or both. When analyzing such solutions, extraneous colors will obviously upset the accuracy of the readings.

To overcome this handicap, a simple device called a comparator may be used. This consists of a rack for holding two rows of test tubes containing the color standards and the unknowns. To cancel out the complicating effect of color or turbidity in the unknown, the color standards are viewed through a test tube containing the unknown without any added indicator. This color is compared with the unknown solution containing added indicator viewed through a test tube of clear distilled water. Since in all cases the color of the indicator is altered in like degree by the color of turbidity of the unknown, the accuracy of the readings is assured.

Requirements of an Indicator

One of the first color indicators to be used was litmus. It has been pointed out that this dye is of only limited use since it does not exhibit sharp color changes for slight changes in pH. Its color variations are noticeable over a range extending all the way from pH 4.4 to 8.9, a total of 4.5 pH units. To be most useful, a colorimetric indicator must show characteristic color changes for very slight variations in pH. In addition, its color changes must be solely due to the presence of hydrogen ions and must not be appreciably affected by such extraneous materials as salts and colloids which may also be present.

A color indicator must be a stable reagent. If it fades rapidly, precipitates, or attains its equilibrium color slowly, it is definitely undesirable.

Indicator Error

If a solution is poorly buffered* or completely unbuffered, the addition of a few drops of indicator may change the pH of the solution and thus destroy the accuracy of the reading. To minimize the error, the pH of the indicator should be carefully adjusted

* Buffers are chemical compounds which, when present in a solution, tend to resist or minimize changes in the pH of the solution when small amounts of acids or alkalies are added.

to the midpoint of its range. In this way, the pH of the indicator will be very close to that of the test solution and its addition to the solution will not appreciably disturb the true pH of the solution being tested. However, if the unknown is properly buffered, the introduction of a small amount of indicator does not materially alter the pH.

It will be recalled that a buffer solution is one which resists changes in pH despite the addition of acid or alkali. If, for instance, 1 ml. of 0.01 normal hydrochloric acid is added to a liter of pure water, the pH immediately falls from 7 to 5. If, however, the same amount of acid is added to a liter of phosphate buffer solution, the drop in pH is scarcely perceptible. This opposition to pH change is called buffering action and is produced in all mixtures of weak acids and their salts. Among the common buffers are acetic acid and sodium acetate, carbonic acid and sodium bicarbonate, and citric acid and sodium citrate. To be useful, the pH of the solution must be within the effective range of the buffering ingredients employed, each set of reagents having its own particular buffering range.

It is impossible to secure accurate results on slightly buffered solutions when using a single wide-range indicator. More than likely, the pH of the indicator itself is far removed from the pH of the test sample, and its addition to the sample may seriously change the sample pH. For this reason errors as high as 3 pH have been observed when analyses have been made with wide-range indicators.

Salt Errors

It has been found that the pH values of certain solutions do not agree when analyzed by colorimetric means and when analyzed electrometrically with a hydrogen electrode, which is taken as the most precise standard of measurement, and which will be the subject of another article. The presence of a neutral salt in the solution, although it has no effect upon the actual pH of the solution, causes the electrometric method to indicate pH values lower than those obtained by the colorimetric technique, depending upon the amount of salt present. Since the hydrogen electrode is regarded as the ultimate standard of pH measurement, the salt error is ascribed to the colorimetric method, and a suitable correction must be applied if it is desired to bring the two results into exact agreement with one another. In most cases, however, the difference is quite small, seldom more than 0.5 units pH, and can usually be ignored even though plating baths are often known for their high concentrations of salts. Whether a true pH is 5.6 or 5.3 is of little significance in the routine control of most plating operations.

Protein Error

Solutions containing geletin or other proteins also show a definite disagreement between pH readings determined electrometrically and colorimetrically. The error depends upon the nature and concentration of the proteins present. Here again, the error is seldom more than 0.5 pH.

Temperature Error

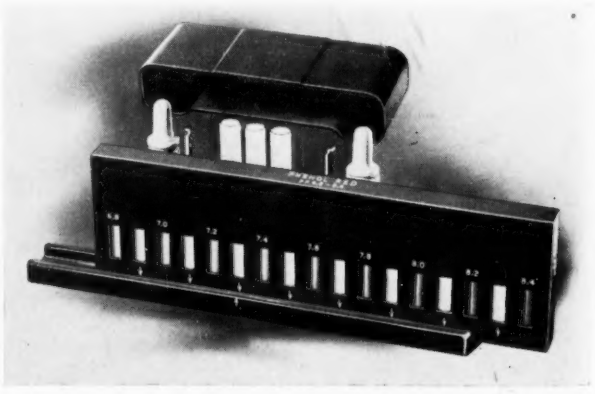
Temperature has a marked influence upon pH readings since it controls, within limits, the degree of ionization and thus the pH of most test solutions. Elevations in temperature increase the degree of ionization of the components in solution. For accurate readings, pH of a solution should be taken at the same temperature as was originally used when measuring the pH of the color standard. For accurate work, it is required that each pH reading on a series of solutions be measured at the same temperature if these readings are to be employed as a basis of comparison. Otherwise, temperature itself will undermine the dependability of the data. For instance, in the case of nickel solutions, not only does the pH change with temperature but the color of the solution itself may change. To avoid errors of this sort, both the test sample and the pH standards should be at the same temperature.

Color and Turbidity Effects

Unless the comparator method of colorimetric analysis is employed, turbidity and color in the unknown may prove to be serious handicaps. Various methods have been suggested as remedies.

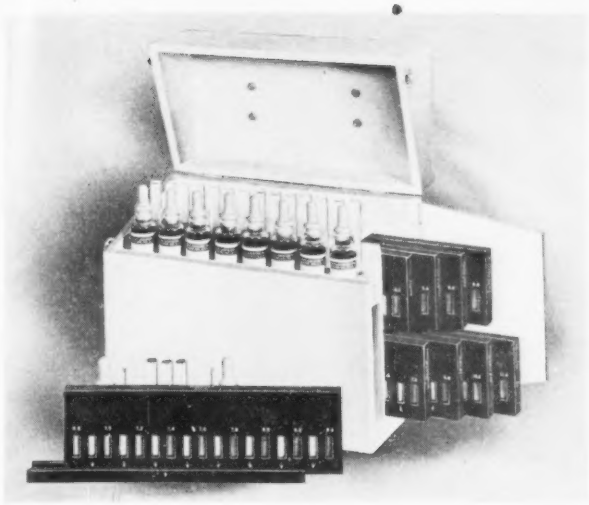
The removal of turbidity by means of filtration has been offered as a solution. However, this procedure is often undesirable. The pH of the unknown may be changed in the process since the solution may readily gain or lose carbon dioxide during filtration. Furthermore, the filtering medium itself may have harmful effects.

If the unknown is highly buffered, the pH of the solution will not be greatly effected if it is diluted even as much as 1 to 50. Dilution is often desirable when the unknown is objectionably colored or turbid since the addition of water reduces the effect of these disturbing influences. Of course, care must be exercised not to add water to such a large extent that the pH of the buffered solution is altered in the process. In all cases, distilled water of high purity must be employed.



(Photo courtesy W. A. Taylor & Co.)

Figure 4—Slide comparator for pH testing.



(*Photo courtesy W. A. Taylor & Co.*)

Figure 5—Wide range slide comparator set, covering the entire pH range.

Storing Color Indicators

Soft glass bottles and cork stoppers should never be used in storing color indicators. Indicators, adjusted to the respective midpoints of their color ranges, should be kept in rubber-stoppered Pyrex bottles at all times. The bottles should be tightly stoppered and their contents exposed to the air as infrequently as possible to avoid the absorption of carbon dioxide.

Colorimetric Equipment

The simplest method of colorimetric analysis involves the use of testpapers. These are usually made by soaking filter paper with an indicator solution. The pH of the test solution is found by spotting the sample on the test paper and noting the color produced. Figure III illustrates a set of test papers covering the entire pH range. The accuracy obtainable by this technique is far below that of the comparator method of analysis, although the ease of operation is greater. Test papers deteriorate, especially if exposed to light, although the errors caused by this action may be minimized if the test papers are discarded after they have been on hand for a specified length of time.

During the performance of the test, the pH of slightly buffered materials may change because of the loss or absorption of carbon dioxide from the air or the absorption of alkaline or acid fumes, which will obviously destroy the accuracy of the results. Some users of test papers prefer to compare their results with color charts prepared for each of the various indicators. Apart from the fact that it is almost impossible to duplicate the colors of the standards at their various pH values, the color charts have a tendency to fade when exposed to light and thus are not completely dependable.

Colorimetric equipment of the comparator variety may be made in the laboratory with the use of test tubes or ampoules and buffered solutions of known pH containing known amounts of indicator solution. Usually, however, it is more satisfactory to purchase such equipment from a reputable manufacturer.

One of the most commonly used colorimetric devices is the slide comparator, which consists of a plastic slide and base. Figure IV shows a commercially available form of this comparator. There are seventeen openings in the slide which hold alternately nine color standards and eight ampoules of distilled water. Each color standard contains the same amount of a given indicator in the presence of a buffer solution of specified pH. The standards are set at intervals of 0.2 pH, except where otherwise stated. The base of the comparator contains a slot along which the slide is allowed to move freely. In the center of the base and behind the slide are three test tubes. Each of these test tubes is filled with 5 ml. of the unknown. To the central test tube is added 0.5 ml. of the indicator solution, which is thoroughly mixed with the sample. The pH reading is obtained by moving the slide in front of the unknown in the presence of the adequate light source. During each run, the vials containing the distilled water are positioned one at a time in front of the central test tube and the resulting image is compared with the color standards imediately to the right and left until a match is finally made. Additional color slides utilizing different indicators may be obtained, although a single base is all that is required. As many as twenty slides may be obtained, covering a pH range from 0.2 to 13.6.

The long-range slide comparator shown in Figure V has the special advantage of covering a wider pH range than an ordinary slide comparator using a single slide. Nevertheless, its principle of operation is the same. Its range extends to a maximum of nine indicators, covering pH values from 0.2 to 13.6. The long-range comparator differs from the ordinary slide comparator in that it includes a wooden carrying case designed to hold, depending upon its size, from three to nine slides which cover different portions of the pH scale.

The roulette comparator* has all the essential features of a slide comparator except that the color standards and the distilled water vials are held in a revolving drum rather than on a flat slide. The standard solutions are rotated about the unknown solutions until a color match is obtained. An artificial light source is provided. The range of this instrument extends over the interval of three sets of color standards and hence is three times that of an ordinary slide comparator equipped with a single slide.

(*To be continued*)

* *LaMotte Chemical Co., Towson, Md.*

Keeping Costs in the Plating Room

By Philip J. Sievering, *Philip Sievering, Inc., New York, N. Y.*

ELECTROPLATING costs have always been something of a mystery to the plater and finisher. Especially among job platers, cost has been a matter of guesswork before doing the job (when estimating) and even after the job has been done.

For this situation one fact is mainly responsible—the plater's aversion or inability to keep records. Most job platers are shop men, not clerks. They are happy at the tank but miserable at the desk; clerical work to them is an unnecessary luxury. This is a fundamental mistake, of course.

There is another reason, however; namely, the real difficulty of keeping a record of work in the plating room. Polishing work is easy to keep track of. The man at the lathe gets a box or pile of pieces and punches the Work Ticket at beginning and end of the run. The record is easy to keep and to read.

The plating room is different. Plating is carried on by groups of men rather than by individuals. A single piece may go through several hands in short time. It is not economical or practical to punch a Work Ticket every 30 seconds. Consequently, plating records are often neglected and costs unknown. This may hide serious discrepancies and losses.

The fact is that plating room labor time can be kept with reasonable and satisfactory accuracy for practical purposes. No new equipment or records are necessary. The only equipment needed is a time clock and standard time cards as in polishing or other manufacturing department. All that is necessary is to *keep records of every operation possible.*

The following paragraphs will illustrate a simple, yet entirely practical method for cost keeping that has worked out very successfully in the author's own shop.

For an example, let us take a job of plating Copper-Nickel-Chromium on a part. We start with the following standard Shop Order form Figures I and II purchasable almost anywhere. A local printer can make up a large supply at a nominal cost.

This form is properly filled in when the job is received, making one carbon copy. The original is retained in the office, and the carbon accompanies the work through the shop operations, and is called a Work Ticket.

This Work Ticket stays with the job from beginning to end. For convenience, the ticket is yellow if it covers the whole job; if the job is too big to go on one ticket it will be spread over two or more tickets, all colored pink and numbered consecutively, with the ticket covering the end of the job marked "last." A yellow ticket, therefore, will show that the whole job is recorded thereon; a pink ticket, that it covers only a part of the job, and for the complete record, all the other pink tickets, including the "last" must be collected. For a full and complete record, all re-runs or rejects are recorded on green tickets, also marked so as to tie in with the yellow or pink tickets.

As shown in Figure II, at the bottom of the Work Ticket is space for the total quantity done and the total time, from which total direct labor cost can easily be figured. To this direct labor cost may be added the cost of materials, the departmental burden or overhead and the percentage for profit. Or the direct labor cost may be multiplied by the proper factor to arrive at selling price.

It is all as simple as that. The hard part, for the small shop especially, is *to do it.*

There are, of course, some instances where hair-trigger records are not practical. For instance, a person unwiring miscellaneous work as it comes from different tanks may take only few seconds on this or

SHOP ORDER

Name_____

Address_____

D 9471

Date_____

Finish_____

Instructions_____

Time Promised_____

Order No._____

Fig. I. Simple shop order form for keeping record of work progress.

that piece, too short a time to record. In such cases, one large job shop operator estimates the unwiring work at the rate of ½ the time spent in wiring (of which record has been kept). Since such "estimated" records form only a small part of his total plating shop cost records, the probable error is small.

In addition to the Work Ticket, another record must also be kept, the Employee's Daily Time and Production Record, as shown in Figure III.

It is important that this Record be *full and complete, accounting for every minute of the employee's time,* including time spent *indirectly as well as directly* on orders; setting up wheels for a particular job, cleaning the lathe to prepare for work, etc., if it is a polishing job; or cleaning benches for racking work, setting up and arranging for cleaning, rinsing and plating, etc., etc. Even time in the wash room should be allotted to the job during which it is taken, as a certain amount of time is always spent for such purposes, and it must

	P.W. QUAN.	P.W. NO.		TIME	
			FINISH		
			START		
			FINISH		
			START		
			FINISH		
			START		
			FINISH		
			START		
			FINISH		
			START		
			FINISH		
			START		
			FINISH		
			START		
			FINISH		
			START		
			FINISH		
			START		

Figure II. Reverse side of shop order form for recording time spent on each shop operation.

be paid for. It is signed by the foreman when handed in for accounting at the end of the day.

The Employee's Time and Production Records tally

PHILIP SIEVERING, INC.

DAILY TIME & PRODUCTION RECORD

DEPT.

OCCUP.

S. O. No.	QUAN. O.K.PC	OPER. SYMB.	STD. HRS.	EARN'D HRS.	TIME ELAP	CLOCK RECORD
						F
						S
						F
						S
						F
						S
						F
						S
						F
						S
						F
						S

Figure III. Daily time and production record contains all information on each operator's daily activities.

with the Work Tickets so that cross-checks will give the same total for time and direct labor cost.

It may be argued by the small shop owner that he has no time clock and no clerks. The answer is that he does not have to have a time clock. His men can report to the foreman or the bookkeeper or post the tickets himself whenever starting or finishing work. Then let the bookkeeper total up records. Even in the small shop that is not too much work.

In the larger shop, the men may report to the foreman for posting or punching the tickets, or even have a girl at the time clock for that purpose. One girl can punch or post tickets for 50 men and can save her cost over and over in the elimination of errors and in saving men's time.

This simple system is applicable to any shop or plant, large or small, for any run of work which lasts one hour or more. For the short "special" jobs, the employee can easily estimate his time when the operation is finished and write in 5, 10 or 15 minutes, as the case may be.

To any job shop, regardless of its size, it is of utmost importance to know its plating costs *on every job.*

"Diana the Huntress" sculptured in lead and colored to appear antique. Located in the W. R. Grace residence, Old Westbury, L. I.

Decorative Finishes for Lead

By Kempton H. Roll, *Lead Industries Association*

WHEN exposed to the atmosphere with no oil or paint film to protect it from nature's spontaneous reactions, most metal surfaces eventually discolor. Iron turns to a familiar and unattractive reddish brown color, called rust. Copper rusts too, but the product is a greenish colored film called verdigris or patina. Contrary to a popular conception, aluminum rusts but the film is transparent and therefore unnoticeable. Lead loses its metallic hue and acquires instead a strongly adherent, grey-colored coating commonly termed patina.

Nature is responsible for this type of coloring but man, usually not satisfied with nature's efforts, while pursuing the dictates of fashion as well as economy, attempts to retard, hasten or alter nature's methods. The fact that man generally contents himself with lead's natural appearance may be considered a resignation to his fate, since even nature cannot alter to any marked degree the pleasing grey appearance of lead.

The natural patina of lead is a microscopically thin, grey-colored film which forms on the metal's surface upon prolonged exposure to normal atmospheric conditions. It is an extremely durable coating. Continued exposure to the elements serves only to strengthen the film and protect the metal underneath from further attack. Artificial patinas or surface colorations, on the other hand, generally are not durable. At best they form only temporary coatings which must be protected from the weather and which seldom can be freely handled without damage to the finish.

Despite this shortcoming, many full and spare-time specialists want to know how to produce special surface effects on lead destined for decorative uses. For those whose interests lie in this direction, the Lead Industries Association has collected several methods for obtaining such decorative effects. They are offered with the reservation that results may vary considerably.

Chemical Methods

For obtaining artistic and decorative effects on metals, chemical methods including heat treatment are not easily matched. They have found commercial recognition as a means of coloring copper, iron, brass and bronze as well as several other metals. For permanence, these methods are generally satisfactory because the chemicals used actually attack the metal's surface. The chemically impregnated colors as a rule cannot be readily dissolved or peeled off except by attacking them with additional chemicals.

Coloring metals chemically does, however, possess several limitations. Many conditions must be met, and once met are difficult to control. They also include techniques which are seldom mastered by the amateur and, if tried, are not often accomplished without exacting their cost in wasted material and labor.

While copper, brass, bronze, zinc, aluminum and

many others have been successfully colored by careful exposure to the proper corrosive conditions, lead does not respond as well to the same treatment. This is easily understood when one realizes that lead has been used for literally centuries as an anti-corrosive material. It has long enjoyed the reputation of resisting the attack of most common corrosives. Therefore since chemical coloring effects on metal are actually brought about by a form of controlled corrosion, it follows that lead would not easily be colored in this manner.

Having forewarned the individual with too little material and time, not to mention too little perseverance, several formulas and methods which follow should give satisfactory results when properly applied.

Surface Preparation

Before attempting to color the surface of lead, it is imperative that any films already present be removed. This can be accomplished by scraping, buffing, wire brushing or rubbing down with steel-wool. If the object to be cleaned is very intricate and consequently difficult to clean by any of the above methods, it is possible to remove thin films by swabbing the lead with a weak solution of nitric acid and then rinsing with water. A solution of trisodium phosphate and sodium carbonate, 2 oz. each per gallon serves the same purpose and is safer to handle. Remember that if unprotected, the cleaned lead surface in time will again become coated with its natural patina. Lead cannot be cleaned and then stored prior to treatment unless coated with parafin or other protective material.

Green

The following process has been used for producing an imitation antique green finish on lead.

Copper Nitrate	8 ounces/gal.
Ammonium Chloride	4 ounces/gal.
Acetic Acid	4 ounces/gal.
Chromic Acid	1 ounce/gal.

This solution is heated and the lead dipped into it, or if this is impractical, the solution may be brushed on. After rinsing and drying, the surface should be lacquered.

Black

Hydrogen sulfide in air easily transforms the natural compounds of lead into sulfides. Lead sulfide is a durable metallic black color. It is possible to produce this black coloring on lead by dipping it in a dilute solution of yellow ammonium polysulfide. The depth of the tone may be varied with arsenic or platinum chloride. Lead may be darkened with a solution of 10% ferric chloride in equal parts of hydrochloric acid and water. In place of the ferric chloride, two other chemicals, 5% ferrous sulfate and 5% arsenious oxide may be substituted.

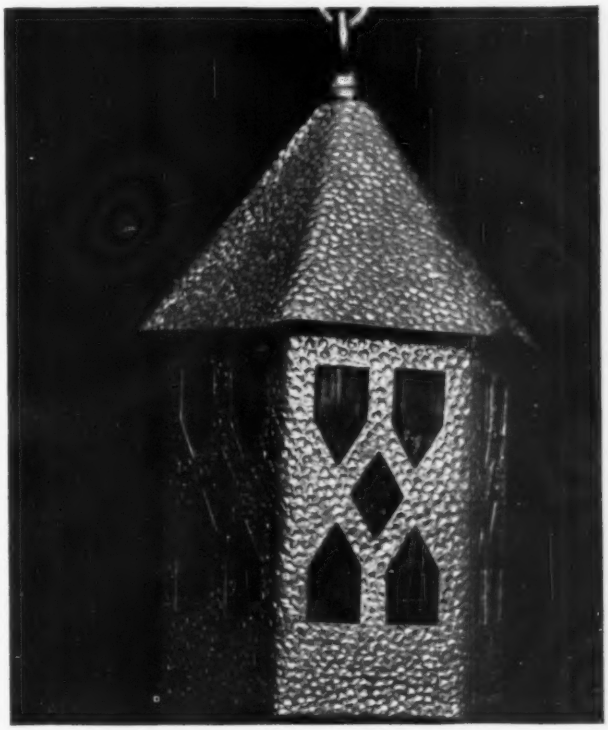
To give lead a jet black finish, a process used by manufacturers of lead ornamental pieces for both inside and outside exposure involves heating the cleaned lead, followed by brush application of warm muriatic (HCl) acid. After brushing on the acid solution to which lampblack is sometimes added, the lead is heated again with a blowtorch. (Remember that lead melts easily!) The surface will turn jet black. After drying, it may be waxed to give a beautiful all-weather finish.

Nature being unpredictable and the artisan in most cases being unwilling to put up with nature's eccentricities, methods have been developed which enable lead to acquire its natural patina at a controlled and even rate. One method is to wipe the lead down with linseed oil before exposing it to the weather. As the oil wears off, the surface acquires a natural, even, durable patina.

In the average suburban locality the home owner with a perfection complex usually finds no fault with the surface appearance of his lead roof or flashings. But on rare occasions an especially meticulous home owner living in a heavy industrial area will insist that the lead on his house be absolutely uniform in color. Industrial atmospheres usually are high in hydrogen sulfide concentration so it is sometimes difficult to keep newly installed lead from developing a non-uniform surface patina.

For occasions such as this it was found that swabbing down the lead with a weak solution of sulfuric acid would passify the lead and thereby prevent irregular sulfide staining.

After applying chemical methods of coloring lead, to retard any further action which may deter from the attractiveness of the coloring, it is important that any adhering chemicals be removed as soon as the desired effect is achieved. Simply washing down with water will do this. Lacquering will protect the newly decorated surface from discoloration or wear.



Easily made, this sheet lead lantern can be surface treated to resemble antique green-stained bronze or given any number of pleasing colors to add to the attractive natural appearance of lead.

Other Colors

Another solution which produces several color effects is made up of 1 ounce of ammonium molybdate in 2 qts. of water made slightly ammonical with ammonium hydroxide. Dipping the lead into this heated solution produces a film of molybdenum sesquioxide and other heavy metal compounds which first give a brass yellow color. Continued exposure develops in order, gold yellow, green, crimson, blue and finally brown and black. Another solution very similar in nature which produces essentially the same results consists of 1 oz. of aluminum chloride and ½ oz. of ammonium molybdate per gallon of water.

Etching

It is possible to etch on lead by covering it completely with an acid resistant mask such as parafin. Merely dip the lead several times in molten parafin. Scratching designs through the parafin exposes the lead beneath to the action of etching or coloring chemicals, such as nitric acid solution or any of the chemicals described above.

Designs outlined in contrasting metal may be obtained by electroplating the exposed areas. (See Plating Methods) After the desired effects are achieved, the masking substance is removed by hot water or by dissolving it in a solvent such as carbon tetrachloride.

Painting Methods

Because chemical methods are difficult to control and do not always give the desired results, many finishers of lead statuary and decorative pieces, such as garden ornaments, ash trays, lamp bases, etc., prefer painting techniques as a means of producing antique or decorative finishes. The principal of this method is simple enough, but the successful practice of it requires considerable experience.

Antique Green

The ancients cast many decorative articles out of bronze and copper. Continued exposure to the elements eventually converted the reddish surface color of these metals to a flat variegated green which in many respects was more attractive than the original coloring. This green stain or verdigris of patina is often referred to as "antique green." Metal finishers and sculptors unwilling to wait for nature's methods to take effect or trying to disguise the base metal beneath frequently put an antique green finish on lead in the manner described below.

(1) First clean the lead object to be colored with a solvent such as naphtha then paint or spray with bronze lacquer or bronzing liquid.

(2) After the lacquer is dry, paint or spray on a coat of flat green paint. No special type of paint is required as long as the green color approaches that of green stained bronze or copper.

(3) When the paint becomes tacky, rub it partly off with a cloth. Careful manipulation of the cloth will produce various degrees of shading and highlighting which will transform an object made of lead into one with a surface finish closely resembling the antique green of bronze or copper.

Several variations of this technique exist. One is to apply the clear bronzing liquid and then while it is still tacky, dust on dry powdered pigments such as umber, green chromate, powdered aluminum or gilding bronzes. No rubbing is required. Many special effects may be achieved in this manner.

Plating Methods

Lead is frequently plated with other metals to enhance its appearance and, in some cases, disguise it. An enterprising counterfeiter furnished a good example of the latter application before his career was prematurely concluded by federal authorities. Not content with the as-cast appearance of "silver dollars" made from lead, he proceeded to plate them with pure silver. This added much to their appearance, but fortunately for those who must earn instead of manufacture their coins, the silver plating did not disguise the dull thud of a phony lead coin. On other more legitimate occasions, lead alloys, including antimonial or "hard" lead, C-T or casket trim metal, die-casting metal, etc., are plated with copper, nickel, chromium, silver, gold and practically any other metal that is capable of being electrodeposited.

There are certain restrictions limiting the metals which can be successfully plated on pure lead. Unalloyed lead is soft and pliable while thin electrodeposited films of many metals are hard and comparatively brittle. For this reason, soft lead is seldom plated with chromium, particularly if the plated object may at some time be bent or twisted. The relatively ductile metals such as copper, silver, and gold, however are frequently plated on soft lead.

Masking

Masking sections of the object to be plated makes it possible to obtain contrasts between the natural patina and the plated metal. By altering plating conditions or by final buffing the plated metal may be given a dull or bright finish. Lead is masked by covering the surface on which no plating is desired with a non-conductive and water insoluble substance. In some plating solutions, it is possible to mask with ordinary scotch tape. In hot plating solutions, masking should not be used which will melt off or otherwise become detached.

Copper Plating

Lead is not only easy to plate with copper but the copper forms a strong, adherent film and becomes an excellent base on which other metals may be plated subsequently. Most other metals do not plate out on lead as well as copper does. For this reason lead to be silver plated is almost invariably given a preliminary copper plate.

A method used commercially for plating copper on

lead will be described. Plating by this method produces a sound, adherent layer of pure copper on the lead surface which can be polished and used as is or plated with other metals.

First the lead is thoroughly cleaned. The commercial practice is to dip the object to be cleaned in a hot trisodium phosphate solution. This is a mild alkali and merely aids in the removal of any oily, greasy films. Solution or any surface oxides is facilitated by making the lead cathodic (negative) for about two minutes followed by a few seconds as the anode (positive). Remove the lead from the cleaner solution and rinse in water. Then give it a brief dip in an acid solution consisting of 25 to 50 per cent hydrochloric acid. Rinse water again and the lead is ready to be plated.

A commonly used electrolyte for copper plating lead is the acid sulfate bath:

Copper Sulfate	27	oz./gal.
Sulfuric Acid	6½	oz./gal.

The anodes are usually made of rolled annealed copper. From ¾ to 2 volts are required with an amperage sufficient to provide about 15 to 40 amperes per square foot of cathode surface area.

The sulfate solution (electrolyte) is contained in a lead-lined or glass tank and kept at about 85° F.

The plate will have a dull finish and may be buffed to bring out a bright polish.

The cyanide plating bath is most frequently used for commercial plating of copper on lead. The electrolyte is made up as follows:

Copper Cyanide	3	oz./gal.
Sodium Cyanide	4½	oz./gal.
Sodium Carbonate	2	oz./gal.

One or two volts with 2 to 15 amperes per square ft. of cathode are the current requirements. Hypo (sodium thiosulfate) up to ¼ oz./gal. is sometimes recommended to improve the brightness of the deposit.

For most applications the simpler acid sulfate electrolyte is preferred over the cyanide bath. It generally plates faster and is more economical because more copper is plated per ampere.

Lead that is perfectly clean and free from any oxide films can be "flash" plated with copper by dipping it into a solution of copper sulfate, 4 oz./gal. and sulfuric acid, 4 oz./gal. No current is required. Continued submersion in the solution does not build up the coating since plating takes place only on exposed lead surfaces. Of course this is only a thin coating of copper and is easily worn off. It is a very poor substitute for regular electroplated copper.

Other metals may then be plated over the copper deposit in conventional plating baths. The most frequently used are nickel, silver, and gold. Gold plating, when used, is usually just a "wash" coating sufficient to give the gold color only, and is best deposited over a nickel undercoating for best color. Many novelty and cheap jewelry items are finished in this way.

The Lead Industries Association is always interested in learning about new or different methods for decorating lead. Readers offering or seeking information about any phase in the uses of lead or its alloys are invited to communicate with the Association at 420 Lexington Avenue, New York 17, N. Y.

Bibliography

1. Correspondence, Lead Industries Association, New York.
2. Guidebook and Directory for Metal Finishing Industries, 1947, Finishing Publications, Inc., N. Y.
3. Krause, Hugo, "Metal Coloring and Finishing", 1938, Chemical Publishing Co., Inc., New York.
4. Private Communication.

THROWING POWER

(*Concluded from page* 55)

This is a matter of extreme *practical* importance because many specifications of plating thickness now call for a certain minimum thickness of deposit; the plater is therefore faced with the problem of deciding what *average* thickness will produce this. Quantitative measurements of throwing power by Haring & Blum's method, or any other, give a qualitative but not a quantitative answer.

One defect of the Haring & Blum's test is that it applies to one primary current ratio (5:1) and one set of interelectrode distances only. If the ratio is changed, or if the dimensions are changed, entirely different results are obtained, so that it is clear that the results are not a fundamental property of the solution. I have suggested in a paper (*Trans. Faraday Soc.* 1938 34 *p.* 698) a rather more fundamental approach by which a constant from any one solution which I have called "the throwing number" can be obtained.

This can then be used for any calculation and is independent of the primary current ratio or scale. This analysis also serves to explain the extraordinarily good throwing power into small crevices, etc., which is difficult to predict from the usual considerations based on Haring & Blum's results.

It must however be admitted that the precise prediction of the thickness of a plated coating on an irregular article is still a very difficult or even insolvable problem, and my own view is that the better line of advance is to consider the problems of uneven distribution at the design stage so that the plater may be presented with a less difficult task in complying with a minimum thickness specification. A British plating specification cunningly avoids the rejection of articles for thin spots in recesses by restricting the tests to surfaces which can be touched with a ball of a given diameter, for example, one inch diameter but this is an expedient best avoided by good design!

GEO. E. GARDAM,

Director of Research, Design and Research Center for the Gold, Silver and Jewelry Industries, London, England.

Shop Problems

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Oxidized Finishes for Bronze

Question: Can you tell us how to produce a "genuine medium bronze" finish on brass and bronze? We understand that this is a chemical bath finish, not electroplated.

J. J. O.

Answer: A specific answer to your problem is impossible. There have been so many terms used to describe finishes for copper base alloys that they are almost meaningless. You are no doubt referring to "oxidized" finishes, in itself a misnomer as many of the actual chemical products produced in the various coloring baths are sulfides, carbonates, etc. Various baths may be used for these oxidized finishes, and many possible results are obtained depending on the time and temperature of the process. Details are given in our Guidebook-Directory. Several proprietary baths are also available, and the names of firms who can supply these materials is being sent to you.

Iridium Plating

Question: Can you send us full details regarding the process for plating iridium? If there are any firms who make prepared solutions for this type of plating we would like to have their names and addresses also.

H. E. W.

Answer: To the best of our knowledge, no plating bath for iridium has yet been developed. One of the prime difficulties lies in the extreme resistance to corrosion of the metal iridium, which makes it almost impossible to prepare solutions of this metal from which deposits might be obtained. It might be possible to obtain deposits of this metal by vacuum deposition or cathode sputtering methods, and we are sending names of firms who may be able to give you further information on the feasibility of this.

Plating Scissors and Shears

Question: We are nickel plating forged steel and cast iron scissors and shears. When the edges are ground the plating peels off at the sharpened edges. Our cycle is to clean in hot alkali, hand scour with pumice, rinse, acid dip, rinse, and plate in standard grey nickel. The deposits are as light as we can make them and still get good color after buffing. This same cycle on other parts seems to give satisfactory results. Can you suggest something to overcome this difficulty?

N. C. W.

Answer: Your trouble undoubtedly lies in non-adhesion and hardness of the nickel deposits. Adhesion would be improved with a preliminary strike in a cyanide copper bath prior to the nickel plating. Softer deposits from the nickel bath may be obtained by operating it at a higher temperature and a lower pH. All organic matter should be kept out of the solution by regular filtering through activated carbon.

Removing Oil Films From Plating Baths

Question: We have had some difficulty in operating our dull nickel solution, in that a thin film of oily matter seems to have accumulated on the surface of the bath. How can this film be removed most economically?

H. G.

Answer: The oily film was no doubt formed from overhead dripping or the use of oil-laden compressed air lines. Most of the film can be removed by skimming the bath, and the final amounts may be removed by placing thin sheets of absorbent wrapping tissue on the surface of the bath. These sheets will soak up the oil and can be lifted off the surface. The treatment should be repeated until the surface is completely free of oily films.

Bright Dipping Nickel Plating

Question: I would like to bright dip my nickel and dull-nickel plated parts in order to produce a bright surface without the need for buffing. Can you give me a formula for doing this?

A. M. L.

Answer: At present, it is not possible to produce a bright, lustrous surface on dull nickel plated articles that will be the equivalent of buffed surfaces by means of a bright dipping operation. Some success has been obtained by electropolishing nickel deposits after plating, but the operation requires close control over several factors and is not applicable to many parts because of their shape. The most practical method for overcoming your difficulty is to use a bright nickel plating bath, from which bright, lustrous deposits may be obtained directly, provided that the surface before plating has been properly prepared. Names of firms who can supply these proprietary bright nickel plating baths are being sent to you. A discussion of the application of electropolishing for brightening nickel plating is contained in the recent book by *Dr. S. Wernick* "Electrolytic Polishing and Bright Plating of Metals."

Karat Gold Plating

Question: We would appreciate any information you can give us regarding a formula for plating gold to match the color of rolled 10K gold, when the

parts are plated by the basket method.

R. L. P.

Answer: In order to match the color of cast gold or rolled gold, a plated gold deposit must be higher in gold content than the cast or rolled alloy; therefore, your deposit in this case will be about 18 karat in gold content. A bath for producing this type of deposit is as follows:

Gold Cyanide	½	oz/gal.
Copper Cyanide	1	gm./gal.
Nickel Cyanide	¼	oz/gal.
Sodium Cyanide	2	oz/gal.
Sodium Carbonate	½	oz/gal.
Ammonium Chloride	¼	oz/gal.

For anodes, 20 karat gold is used, and the bath is operated at about 140° F. Close control over all factors is required for consistent results.

Several firms market prepared solutions for doing this type of work, and unless you are equipped for close analytical control it might be easier for you to use these prepared solutions. A list of firms who can supply these materials is being sent to you.

Plating Screw Threads

Question: We do a lot of plating of small screws of various sizes, which we manufacture, in both Cadmium and Nickel, and have always had difficulty in maintaining size after plating, due to the uncertain build-up that occurs during the plating operation. We have tried several methods of overcoming our troubles, but none seem to keep us out of trouble. How do others handle this sort of problem, which we imagine must be common to the industry?

O. S. B.

Answer: There are several methods for eliminating most of your difficulties when plating screw threads. The easiest method in the long run is to use undersize dies and chasers when machining the screws, to allow for the build-up during plating. You need not purchase special tools for this, as you can chrome plate regular sizes of dies, thus getting them slightly undersize and producing a superior wearing surface on the tools at the same time. The thickness of the chrome plating is easily controlled, and will usually pay for itself in the longer cutting life imparted to the tools. Another method, which is more difficult to control, however, is to pickle the screws in acid until they have been reduced in size sufficiently to allow for the plating thickness. This is the less desirable of the two methods, as the strength of the pickle used must be carefully controlled, and also because the pickling operation often weakens the screws. Your barrel operator should be supplied with a thread gauge, and he can scoop out a handful of the screws at intervals and check them for size, stopping the plating when they have received sufficient plating on the threads. Any method used will require close control over all stages of processing. This may seem costly at first, but once a routine has been established you should be able to produce consistent results. During the last war many firms dealt successfully with this problem in the above way.

Coloring Brass

Question: We have heard that there is a bath for coloring brass that can produce many different colors from the same bath. Can you give us any information on such a formula?

W. M. C.

Answer: Interference colors on brass may be obtained from a bath of the following composition:

Lead Acetate	10	oz/gal.
Sodium Thiosulfate	6¾	oz/gal.
Temperature	about 180°F.	

The first colors produced after immersion of the cleaned brass parts will be pale yellow, then will change successively to darker yellow, brownish orange, purple, blue, and darker blue. The timing for production of a given color must be carefully watched, the parts being removed from the bath when the desired color has been obtained. The colors obtained are due to the reflection of light from the underlying brass metal through the increasingly thick film of lead sulfide formed as the treatment progresses.

Several proprietary materials are available for producing various colors on brass and copper alloys, and names of firms who can supply these materials are being sent to you.

PROFESSIONAL DIRECTORY

SCIENTIFIC CONTROL LABORATORIES
Finishing Consultants—Registered Engineers
Salt Spray—Thickness Testing—Analyses
PLANNING—RESEARCH—DEVELOPMENT
HAymarket 1-2260
600 BLUE ISLAND AVENUE CHICAGO 7, ILL.

JOHN W. MAGLY
Consulting Chemical Engineer
ELECTROPLATING PROCESSES
DEVELOPMENT—ANALYSES
TROUBLESHOOTING PLANT PROCESSES
2731 Vine St. Cincinnati 19, Ohio
Avon 3977

G. B. HOGABOOM JR. & CO.
Consulting Chemical Engineers
Metal Finishing—Electrodeposition—Testing of deposits—salt spray, thickness, composition, porosity. Solution analyses, plant design, process development.
44 East Kinney St. Newark 2, N. J.
MArket 3-0055

JOSEPH B. KUSHNER, Ch.E.
Metal Finishing Consultant
Problems in Automatic Plating, Electroforming and Plastic Plating; Plating Plants Installed.
233 W. 26th St., New York 1, N. Y.

"ELECTROCHEMICAL TECHNOLOGY"
E. J. HINTERLEITNER
and
Associated Engineers
•
669 SUMMIT AVENUE
WESTFIELD, NEW JERSEY
Phone: Westfield 2-4766
•
UP-TO-DATE CONSULTING SERVICE
for the
METAL FINISHING INDUSTRY

PLATERS TECHNICAL SERVICE, INC.
ELECTROPLATING AND CHEMICAL ENGINEERS
A complete service for metal finishers including solution and deposit analyses, process development and plant design.
New York Laboratory
59 East 4th St. New York 3
ORchard 4-1778
Chicago Laboratory
509 S. Wabash Ave. Chicago 5
Harrison 7648

We analyze all plating solutions. Very reasonable. 24 hour service. Information sent on request.
PLATERS' LABORATORY SERVICE
648 JACKSON AVENUE
ELIZABETH, NEW JERSEY
Elizabeth 2-8608

Patents

Patents Available for Licensing or Sale

A recently announced decision by the E. I. DuPont de Nemours Co. and the General Aniline and Film Corp. has made available for licensing or sale over 7000 patents owned by these firms. Patents of interest to firms in the metal finishing field cover cleaning with chlorinated solvents, stabilization of chlorinated hydrocarbons for metal cleaning, cyanide plating baths, manufacture of cyanides, black finishing chrome plated articles, alloy plating, brass plating, white brass plating, bright copper plating, tin plating, methods for plating magnesium, silver plating, stripping and plating in a single bath, and many others. All the above are presently owned by DuPont. General Aniline and Film lists mostly detergents, water softeners, and other surface active agents.

Complete listings may be obtained from the U. S. Patent Office, and all inquiries regarding the details of any individual patent should be addressed to the patent department of either firm, *E. I. DuPont de Nemours & Co., Patent Div., Wilmington* 98, *Del.*, or *General Aniline and Film Corp., Patent Dept.*, 247 *Park Ave., New York* 17, *N. Y.*

Method of Coating by Evaporating Metals

U. S. Patents 2,450,850-2,450,857. *William H. Colbert and Arthur R. Weinrich, assignors to Libbey-Owens Ford Glass Co.*

The method of making mirrors by the deposition of a metal on a polished support material, comprising evaporating a metal from a filament made of a metal selected from the group consisting of tungsten, tantalum, molybdenum and columbium wherein the metal is heated on such filament as an alloy with metals of the calcium family; aluminum; magnesium; titanium; manganese; chromium; or zirconium, which causes the metal desired to be evaporated to wet, to adhere to, and to spread out over the filament surfaces and by the continued application of heat to evaporate, and depositing a coating thereof on said polished support material.

Electrodeposition of Tin

U. S. Patent 2,450,795. *Elmer F. Harris, assignor to Carnegie-Illinois Steel Corp.*

An electrolyte for deposition of tin consisting of an aqueous solution of 10 to 60 grams per liter of tin, an acid of the group consisting of phenol sulphonic acid, sulphuric acid, fluosilicic acid, benzene sulphonic acid, cresol sulphonic acid, chlorobenzene sulphonic acid, and nitrobenzene sulphonic acid, the range of acid being 35 to 110 grams per liter for phenol sulphonic acid and the molecular equivalent for the other acids, 1 to 9 grams per liter of dihydroxy diphenyl sulphone, and 0.02 to 50 parts per million by weight of diphenyl-para-phenylenediamine.

Method of Producing Articles Having Fissured Chromium Surface Electrodeposits

U. S. Patent 2,450,296. *Frank Passal, assignor to United Chromium, Inc.*

In a method of producing fissured networks in the surface chromium electrodeposits, heating chromium electrodeposits which are predisposed to the formation of fissured chromium of the "mud crack" or "channel" type of a size greater than .008" average plateau diameter to temperatures and for times within the ranges

	Hours
212° F.	1¼
350° F.	2
500° F.	2

and thereafter etching the heat-treated chromium electrodeposits at the temperature of the etching bath to develop a fissure network therein, the plateau areas of which networks being reduced to ⅔ to ¼ of the size which would be obtained on etching without the previous treatment.

Tin Plate Treatment

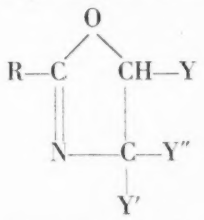
U. S. Patent 2,450,508. *Charles E. Glock, assignor to Crown Cork & Seal Co., Inc.*

In the method of treating a continuous strip of tin plate in a line wherein the tin coating is electrolytically deposited and then flow brightened, the steps of treating such bright finished tin plate to render the same resistant to the action of food acids and sulphur stains comprising subjecting the surface of the flow brightened tin plate to a light rubbing action which does not deteriorate the flow brightened finish, then subjecting the brightened tin plate to an aqueous acid electrolytic bath in which the tin plate is the cathode for from about three to about ten seconds, the bath being maintained at a temperature between about 170° F. and 200° F. and the current density at the cathode being about ten amperes per square foot to about 100 amperes per square foot, the bath consisting essentially of about 0.25% to 5.0% chromic acid and not more than about 0.01% SO_4 radical.

Rust Preventive Chromium Compounds

U. S. Patent 2,450,807. *Paul R. McCarthy, assignor to Gulf Research & Development Co.*

A chromium-containing product obtained by heating an oxazoline compound having the general formula



wherein R represents the hydrocarbon residue of an acid selected from the group consisting of higher fatty acids, naphthenic acids, and acids derived from the liquid phase partial oxidation of petroleum products, Y and Y′ each represents a substituent selected from the group consisting of hydrogen and lower alkyl groups and Y″ represents a substituent selected from the class consisting of hydrogen, lower alkyl groups, and lower hydroxyalkyl groups, with chromium trioxide at a temperature between about 100° C. and about 250° C.

A composition of matter adapted to prevent corrosion of metal surfaces, said composition consisting of from about 25 to about 75 per cent by weight of the product defined by claim 1 and from about 75 to about 25 per cent by weight of a petroleum distillate solvent for said product.

Rust Preventive Chromium Compounds

U. S. Patent 2,450,806. *Paul R. McCarthy, assignor to Gulf Research & Development Co.*

A composition of matter adapted to

prevent the corrosion of metal surfaces comprising about 25 to about 75 per cent by weight of the water-insoluble product obtained by heating 2-oleyl-4-methyl - 4 - hydroxymethyl - 2 - oxazoline with chromium trioxide at a temperature within the range of about 300° to about 500° F. and about 75 to about 25 per cent by weight of a light naphtha solvent.

A composition of matter adapted to prevent the corrosion of metal surfaces consisting of a light naphtha solvent, a water-insoluble soap and the water-insoluble product obtained by heating 2-oleyl-4-methyl-4-hydroxymethyl-2-oxazoline with chromium trioxide at a temperature within the range of about 300° to about 500° F.

Electrolytic Deposition of Indium

U. S. Patent 2,452,361. *John Robert Dyer, assignor to The Indium Corp. of America.*

A bath for electrolytic deposition of indium which consists essentially of a solution resulting from dissolving indium hydroxide in formamide, said solution having a concentration of from 10 to 100 grams per liter of indium hydroxide in formamide.

Plating Palladium

U. S. Patent 2,452,308. *George C. Lambros.*

A process of electrodepositing palladium which comprises dissolving freshly precipitated dichlorodiamine palladium in an aqueous solution of cyanide of the group consisting of sodium cyanide and potassium cyanide, said solution containing cyanide in an amount ranging from 0.63 to 0.69 gram of cyanide (CN) per gram of palladium in the form of dichlorodiamine palladium, and from 0.5 to 15 grams of palladium metal per liter, and electrolysing said solution in the presence of said cyanide at a temperature of about 90° C., and replenishing the solution periodically to maintain the palladium content of the solution from 0.5 to 15 grams of metal per liter.

Reverse Current Electroplating

U. S. Patent 2,451,340. *George W. Iernstedt, assignor to Westinghouse Electric Corp.*

In the method of electroplating a metal from the group consisting of iron, lead, indium, platinum, osmium, rhodium, iridium, palladium, ruthenium and alloys in which these metals predominate, on a base member from an aqueous electrolyte having the metal to be plated dissolved therein, the steps comprising applying a plating electric current to the base member for a period of time of not more than 40 seconds to electroplate an increment of the metal thereon, then applying a deplating electric current to the base member for a shorter period of time to deplate a substantial portion of the previously plated increment, the deplating electric current being of a magnitude and applied for a period of time sufficient to deliver from 1/20 to ½ of the coulombs delivered during the preceding plating period, and continuing the alternate plating and deplating until a desired thickness of the metal is applied to the base member.

Cleaning Lead Anodes Used for Chromium Plating

U. S. Patent 2,456,281. *Jacob Hyner, assignor to United Chromium, Inc.*

A method of removing incrustations from lead anodes used for chromium plating such incrustations being mixtures of lead oxides and lead chromate, comprising suspending the lead article in an aqueous solution consisting essentially of an alkali-metal pyrophosphate, and passing current to the aforesaid lead article, connected in circuit in said solution as a cathode, and cathodically reducing the incrusted mixture of lead oxides and lead chromate to lead.

Lead Coating Ferrous Articles

U. S. Patent 2,456,235. *William Yonkman, assignor to Western Electric Co., Inc.*

The process of applying a protective coating to ferrous metal articles which comprises cleaning the articles in a hydrochloric acid solution, dipping the articles in a zinc ammonium chloride fluxing bath, dipping the articles without drying them into a lead bath containing from one to six percent of antimony, maintaining on the surface of said lead bath a flux comprising a layer of zinc ammonium chloride at least one-eighth inch thick, maintaining said lead bath at a temperature of between 670° and 690°F., aging said lead bath for approximately forty-eight hours before using it, and maintaining the articles wet with the zinc ammonium chloride during their transference to the lead bath.

Metallization of Non-Conductors

U. S. Patent 2,454,610. *Harold Narcus.*

Method of applying a conductive copper film to the surface of an electricity non-conducting article comprising activating the surface to produce nuclei of reductive ions in the pores thereof by application of an acidic solution containing titanium oxide, immersing the article in a solution containing an aqueous acidic chloride salt solution of a metal selected from a group consisting of copper, gold, palladium and platinum and then directly immersing in a solution containing copper fluoborate and a fluoborate solution of a metal selected from a group consisting of cobalt, nickel, zinc and iron, the last named solution also containing a copper reducing agent.

Rust Preventive Slushing Compounds

U. S. Patent 2,453,816. *Hans Schlindler and Paul T. Anderson, assignors to The Pure Oil Co.*

A slushing oil composition consistingof from 15-30% by weight of lead-wool grease soap having a neutralization number of about 3, from 30-50% by weight of mineral oil having a viscosity at 100°F. of from 60 to 150 seconds Saybolt, from 1-3% by weight of a higher alcohol ester of an alkali metal sulfo-succinic acid and the balance a low-boiling hydrocarbon liquid having a flash point of at least 100°F.

Protection of Non-Ferrous Metal Surfaces

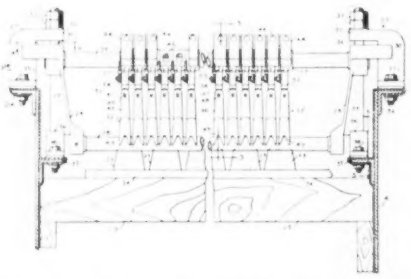
U. S. Patent 2,453,764. *Eugene Snyder, assignor to American Chemical Paint Co.*

For metallic surfaces having as a major constituent a metal chosen from the group consisting of copper, zinc and cadmium, a process for increasing resistance to corrosive influences which comprises the steps of treating the metal surface with an aqueous solution the essential active ingredients of which, per 100 ml. of solution, consist of an alkali chromate equivalent to at least 5 grams of sodium chromate and an alkali cyanide equivalent to from ½ to 10 grams of sodium cyanide, and thereafter washing the surface with a water rinse.

Continuous Wire and Strip Electroplating

U. S. Patent 2,454,935. *Constantine G. Miller, assignor to The Meaker Company.*

Apparatus for electroplating simultaneously a plurality of strips comprising a tank containing electrolyzing solution, a plurality of fixed soluble anodes in said solution, means for moving said strips through the solu-

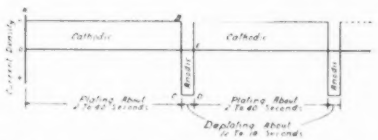


tion, and means for maintaining a relatively constant distance between said strips and anodes, said last mentioned means comprising a frame including an upper and a lower rod extending in parallel relationship across said tank, said lower rod comprising a supporting member located beneath the strips and adapted to be located beneath the surface of the electrolyzing solution and supporting said strips in parallel relationship, said frame having means for adjusting said lower rod and the strips supported thereon toward said anodes as said anodes become smaller, a plurality of conducting fingers swingably mounted on said upper rod and yieldably held in contact with the strips, and an insulating sleeve mounted on each of said fingers, said means for maintaining a relatively constant distance between said strips and anodes including brackets mounted on the tank sides, vertically mounted screws and nuts mounted on said frame, said screws extending through said brackets and supported thereon, a pair of arms forming parts of said frame and extending downwardly on opposite sides of the tank and connecting together in rigid relationship said upper and lower rods for adjustably maintaining the position of said frame, including said lower rod, and guides on the opposite vertical sides of said tank for guiding said pair of arms, said lower rod and said conducting fingers and for opposing the frictional drag of said strips on said fingers and lower rod, said arms serving to maintain the proper distance between the lower ends of said fingers and said lower rod.

Reverse Current Electroplating

U. S. Patent 2,451,341. *George W. Jernstedt, assignor to Westinghouse Electric Corp.*

The process of electroplating metal from the group consisting of copper, brass, silver, zinc, tin, cadmium and gold on a base member from an electroplating electrolyte in which the deposited metal is readily soluble on the passage of electric current when the base member is the anode, comprising the steps of connecting the base member to be plated into an electroplating circuit including the electrolyte, causing electric current to flow in the plating circuit while the base member is in contact with the electrolyte, the electric current flowing in the plating circuit being periodically reversed so as alternately to electroplate metal on and then deplate metal from the base member, the current for plating metal on the base member being caused to



flow for a period of time of not over 40 seconds until a layer of metal is deposited when the current is reversed in direction for a period of time of not over 10 seconds to deplate metal from the base member to remove a portion of the layer of plated metal, the deplating current being of a magnitude and applied for a sufficient period of time to deliver at least 10% of the coulombs delivered during the preceding plating period so that a substantial amount of the plated metal is removed, and repeating the cycle of plating and deplating to cooperate in building up on the base member an electrodeposit in small increments to produce a smooth, sound, homogeneous plate.

Corrosion Preventive

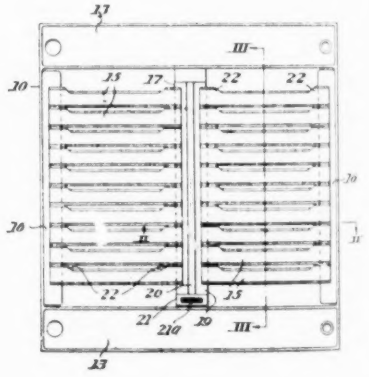
U. S. Patent 2,453,833. *William S. Davis, Jr., and Donald L. Wright, assignors to Standard Oil Development Co.*

A rust preventing composition consisting of (1) a mineral oil base which vaporizes completely below 750°F., (2) a partially volatile corrosion inhibitor consisting of sodium petroleum sulfonates and degras in a ratio of one to two parts of degras to one part of sulfonates, the quantity of such corrosion inhibitor being so proportioned that it is sufficient to prevent corrosion but is not so great that the unvolatilized residue remaining after being subjected to a temperature of 750°F. exceeds 10% by weight of the total composition, and (3) a polybutene of 60,000 to 80,000 molecular weight, the quantity of said polybutene being so propotioned as to impart to the total composition a viscosity of 350 to 1,000 seconds Saybolt at 210°F.

Anode for Electroplating

U. S. Patent 2,453,481. *Abram B. Wilson, assignor to National Steel Corp.*

In an electroplating apparatus wherein a plurality of anodes are disposed in spaced, side-by-side relation in a bank in an electroplating bath, the combination of a plurality of anode bars and spaced guides in said bath for supporting the anode bars and over which they may be moved, one of said guides being an electrical contact member for supplying current to the anode bars, each anode bar comprising an elongated body portion, the cross section of which is quadrilateral, and quadrilateral end portions adapted to ride on said guides, said end portions being of greater cross-sectional area than and extending laterally beyond said body portion, and having coplanar



faces parallel to the axis of the body portion, the faces of the end portions resting on the guides, together with the corresponding faces of adjacent anode bars, substantially completely covering the portions of the guides traversed by the anode bars as they are moved therealong.

Engineering Information Useful In Designating Metallic Surface Treatments

Engineering Data Sheet

Galvanic Corrosion of Metals in Salt Water

One of the most troublesome problems in the choice of metallic alloys and plated metals for use in salt water, or in coastal areas where salt corrosion is a major factor, is the relative activity caused by dissimilar metals in contact forming a galvanic cell which promotes rapid deterioration of the anodic metal or alloy. The following tabulation of the relative activity of commercial alloys will be found helpful, although it should always be remembered that other factors and other corrosive media may alter this relative activity. The tabie is therefore to be used as a general guide only, and for exact data an actual corrosion test should be made. Metal combinations that are furthest apart in the tabulation can be expected to form galvanic cells of greater activity, and hence higher rates of corrosion, than metal combinations that lie closer together in the series.

1—Magnesium Alloys (all)
2—Pure Zinc (Zinc Plating)
3—Galvanized Steel or Iron
4—Aluminum Alloys (low alloy and non-copper alloy types #2S, 3S, 52S)
5—Cadmium (Cadmium Plating)
6—Aluminum Alloys (Copper alloy types such as Dural and Super Dural 17St and 24ST)
7—Low Carbon Steel (unprotected)
8—Wrought Iron
9—Cast Iron
10—Straight Chrome Stainless Steel —Type 410
11—Soft Solder (50-50 Lead-Tin)
12—Stainless Steel 18-8 (active)
13—Lead (Lead Plating)
14—Tin (Tin Plating)
15—60-40 Brass (Muntz metal)
16—Manganese Bronze
17—Naval Brass (60-39-1)
18—Nickel (active)
19—Inconel (active)
20—70-30 Brass (Brass Plating)
21—80-20 Brass (Red Brass Bronze Plating)
22—Copper (Copper Plating)
23—Silicon Bronzes (Everdur, Duronze, etc.)
24—Nickel Silvers (German silvers)
25—Cupro-Nickels
26—Cast High-Tin Bronzes
27—Nickel (passive)
28—Monel Metal
29—18-8 Stainless (passive)

Recent Developments

New Methods, Materials and Equipment for the Metal Finishing Industries

Push-Button Variable Speed Polishing Lathe

Chas. F. L'Hommedieu & Sons, Inc., Dept. MF, 4521 Ogden Ave., Chicago 23, Ill.

A new development of the above firm is a variable speed polishing and buffing lathe having a simplified meth-

od for changing the arbor speeds. Instead of the operator having to turn a crank, it is only necessary to press a button to immediately change the arbor speed. The driving sheave is so arranged that one can obtain a ratio of 2-1 in this manner for operations requiring a high or low speed. On jobs where this quick changeover is necessary, considerable of the operator's time is saved. This feature, together with the infinitely variable speed obtainable with the regular hand wheel speed changer, makes this new lathe a very versatile piece of equipment for the busy polishing room.

Full details may be obtained by writing to the above address.

New Dip Treatment for Zinc

United Chromium, Inc., Dept. MF, 51 East 42 Street, New York 17, N. Y.

The above firm has announced the development of Unichrome Dip Compound 95, which is used to produce corrosion-resisting, conversion coatings on hot dipped zinc, plated zinc, and zinc die castings. Depending on the degree to which Compound 95 is diluted, one of the following finishes is produced: 1) on zinc plate, a clear bright finish that looks like chromium or an olive drab finish; 2) on zinc die castings, a clear, bluish finish, or an olive drab finish; 3) on hot dipped zinc, a bright spangled finish, or an olive drab finish; 4) on all zinc, a coating which serves as an excellent base for paint, lacquer, or enamel.

The process is said to be especially good for finishing wire goods, small parts, and parts on which it is economically impossible to deposit enough copper, nickel, and chromium to provide the necessary corrosion resistance. Typical of the parts now being given the bright, chromium-appearing finish are ice skates, refrigerator shelves, screws, hinges, and fan guards. Parts being processed in the olive drab finish include die cast automotive fuel pumps and carburetor bodies.

Further information on Unichrome Dip Compound 95 may be obtained by writing to the above address.

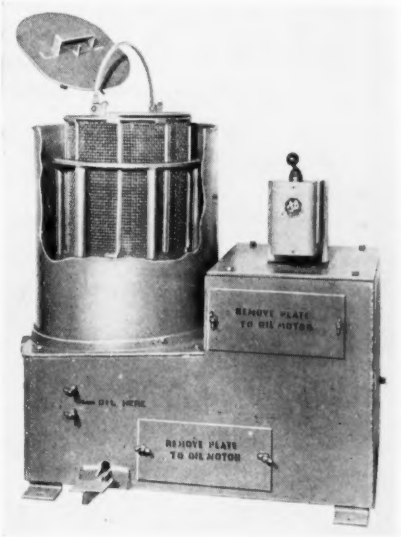
Centrifugal Dryer for Small Parts

New Holland Machine Co., Dept. MF, New Holland, Pa.

A centrifugal dryer which dries a basketful of small parts in only 35 seconds has been added to the line of the above firm.

The New Holland Kreider centrifugal dryer is operated by one man in a minimum of floor space. Of steel construction, the dryer requires 32" x 18" for the standard unit pictured above; 44½" x 19½" with steam heating unit; 54" x 22½" with gas heating unit. The standard unit is 27" from floor to top of basket cage and 30" to top of outside cage.

The 12" x 12" basket, standard equipment with each dryer, is made of heavy gauge steel woven mesh and steel frame. The basket rotates at 625 r.p.m. A ¾ h.p. motor provides ample power for efficient, economical operation. The motor is protected against moisture. It can be operated in either direction, a fast-action foot



brake stopping the basket almost instantly for reversal.

A V-belt drive eliminates all gear noises while a special belt tightener operates constantly while the motor is running. Two large anti-friction ball bearings carry the main spindle shaft. Outside grease fittings permit easy greasing of main spindle shaft.

Strippable Coatings for Metal Protection

Minnesota Mining and Mfg. Co., Dept. MF, 900 Fauquier Ave., St. Paul 6, Minn.

A removable protective coating which protects polished metal stock from die marks, scratches and abrasion during cupping, forming and drawing operations is announced by this firm. The coating can be sprayed, brushed or roll-coated on finished metal surfaces.

It can be left in place from the mill

to the point of sale, throughout fabrication, and can be hand-peeled off in large sheets or blown off with compressed air, it was announced.

Called "3M" Strippable Coating, the new protective film is a product of the adhesives and coatings division of the firm, which also produces over 1,000 industrial adhesives, sealers and coatings.

The coating, available in a variety of colors, is applicable to glass and other non-porous materials as well as metals. It is a translucent film which is shock absorbent and abrasion resistant, with "excellent resistance to water, gasoline and oil," according to the 3M company's laboratories.

Coverage is 250 to 300 square feet

per gallon for a one mil sprayed coating, which air-dries in approximately three minutes or can be oven-dried in less than a minute. The compound has a synthetic resin base and a solvent vehicle.

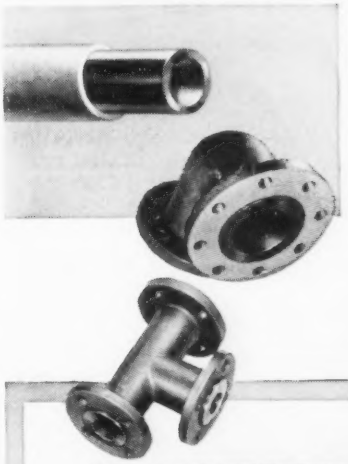
New Steam Gun

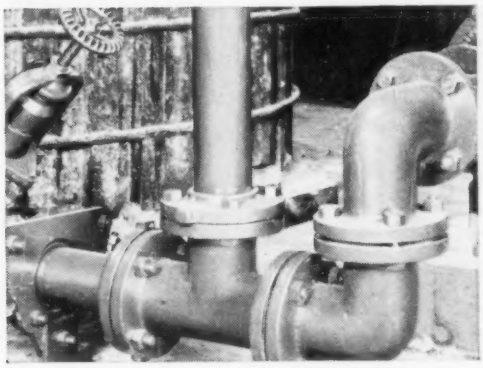
Oakite Products, Inc., Dept. MF, 118 Thames St., New York 6, N. Y.

The above firm has announced the addition to the company's line of steam-cleaning equipment of the Oakite Solution-Lifting Steam Gun, Model 481, designed to facilitate volume cleaning operations in industrial plants.

The outstanding feature of this new gun, the manufacturers report, is its ease of handling, made possible by its special construction. The gun, with an over-all length of 5 feet, is ruggedly constructed and so balanced that it may be used over extended periods without tiring the operator. Two spade-type insulated handles are provided on the

saran lined steel pipe





resists corrosion

- reduces shut-downs and lost production!
- saves time and labor!
- readily field-fabricated!

The conveyance of corrosive liquids can prove as hard on profits as it is on equipment. Saran Lined Steel Pipe is designed and constructed to protect YOUR profits. It combines the desirable features of steel pipe—rigidity and pressure strength—with Saran's unusual resistance to most corrosive chemicals, solvents, and erosion. Another advantage is ease of field fabrication. For general service, Saran Lined Steel Pipe can be used at temperatures between —40° and 190°F.

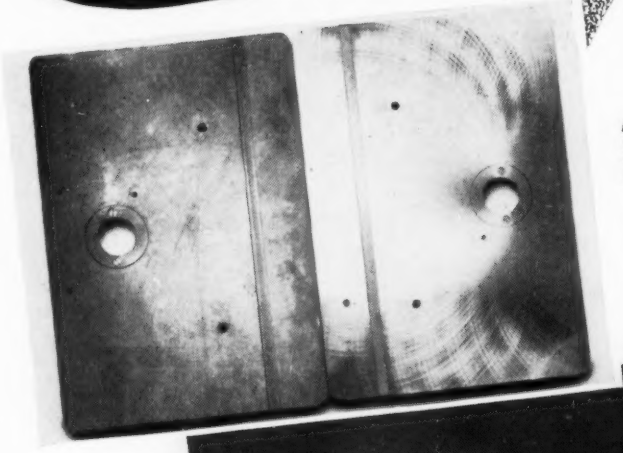
Saran Lined Steel Pipe comes in maximum lengths of 10 feet and in sizes from 1 to 4 inches. Plug valves and fittings, also Saran Lined, include elbows, tees, companion and reducing flanges, and gaskets. AVAILABLE IMMEDIATELY. Write us today for further information concerning Saran Lined Steel Pipe and how it can solve your problem. Manufactured by The Dow Chemical Company, distributed nationally by Saran Lined Pipe Company.

SARAN LINED PIPE COMPANY
702 Stephenson Building
Detroit 2, Michigan

Offices in: New York • Boston
Philadelphia • Pittsburgh • Chicago
Tulsa • Indianapolis • Houston
San Francisco • Los Angeles
Portland • Seattle • Toronto
Denver • Cleveland

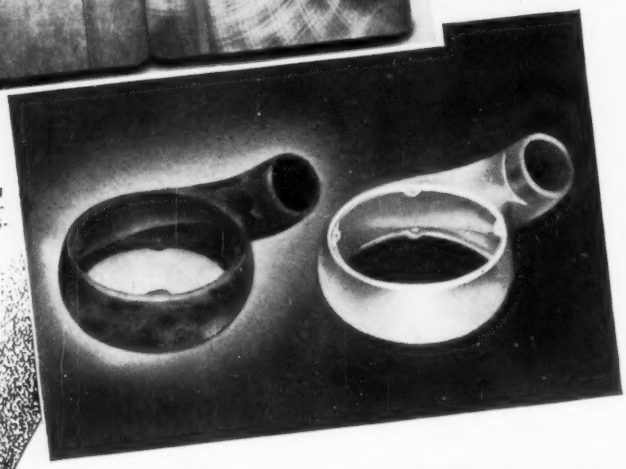
DOW
CHEMICALS INDISPENSABLE
TO INDUSTRY AND AGRICULTURE

PRECLEAN with MAGNUSOL



Machined steel plate before and after pre-cleaning with MAGNUSOL.

Aluminum casting before and after pre-cleaning with MAGNUSOL.



- To Remove Stubborn Buffing and Polishing Compounds.
- To Insure Solid Particle Removal, Particularly after Deep Draw.
- To Remove Slushing Oils.
- Wherever It Is Desirable to Cut Down Time of Contact with an Alkaline Cleaning Solution.

Precleaning with Magnusol solution insures the removal of solid dirt particles which are usually unaffected by vapor degreasing or solvent cleaning. It gives a physically clean surface.

It insures the removal of all stubborn dirts which tend to resist alkaline cleaning action in the preparation of a chemically clean surface for plating, vitreous enamelling, etc.

Precleaning with Magnusol is speedy, effective and economical. Work is simply dipped in (or sprayed with) the solution for about 30 seconds, then rinsed clean with a water spray. Magnusol is safe for all metals—non-corrosive, non-toxic and non-flammable. It can be used at room temperature.

Proper pre-cleaning will cut your over-all finishing costs by large margins. Ask us for recommendations in terms of your particular processes.

MAGNUS CHEMICAL COMPANY • 11 South Ave., Garwood, N. J.

IN CANADA—MAGNUS CHEMICALS, LTD., 4040 Rue Masson, Montreal 36, Que.

Service representatives in principal cities

IN METAL CLEANING IT'S Magnus

CLEANERS • EQUIPMENT • METHODS

gun, and are so situated that each of the operator's hands support the same weight during a high pressure steam cleaning operation. The forward handle of the gun remains stationary in the operator's grasp as the gun is rotated, while the rear handle is easily turned to rotate the gun when cleaning "underneath" and hard-to-reach surfaces. Steam and solution hoses are connected to the gun by swivel joints and remain stationary when the gun is rotated, thus eliminating bothersome twisting of hose lines during the cleaning operations. The whole gun-nozzle, tubes, valves and horses, therefore, turn freely as a unit as the back handle is moved. A special safety feature is a reinforced rubber apron backing up the steam valve and other hot fittings to protect the operator from possibility of burning.

The Oakite Solution-Lifting Steam Gun, Model 481, the manufacturers state, develops sufficient vacuum to discharge cleaning solutions to a height of over 12 feet to permit rapid thorough cleaning of large-equipment surfaces. Readers desiring additional data regarding this new steam gun may obtain same, without charge, by writing to the above address.

Portable Conveyor and Loading Unit

Triangle Equipment Co., Dept. MF, 45 River Road, Nutley, N. J.

The Tipp-Toter, a new and extremely useful conveyor and loading device, has been announced by the above firm. This power driven conveyor will handle

loads up to 300 lbs., and has a maximum delivery height of 10½ feet. Speeds up to 50 ft. per minute are obtainable, and the position of the conveyor can be instantly changed for quick adaptability to new jobs. The unit is light in weight, but sturdily constructed for rugged and continuous use, and its easy portability and small storage space make it ideal for the smaller shop where a great variety of handling jobs must be performed. Complete details may be obtained by writing to the above address.

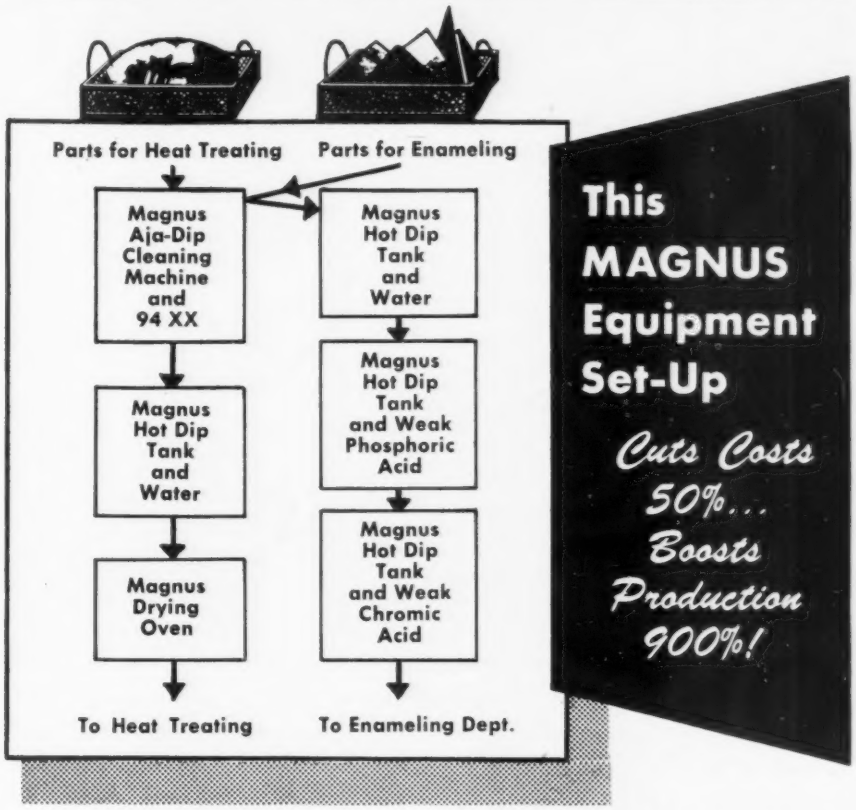
New Bantam Demineralizer

The Barnstead Still & Sterilizer Co., 161 Lanesville Terrace, Dept. MF, Forest Hills, Boston 31, Mass.

The above firm has announced a

new Bantam Demineralizer with more than double the capacity of earlier models. It is a renewable cartridge unit, and the new high capacity cartridge contains both cation and anion resins of improved effectiveness, it is claimed. Each cartridge now has capacity to remove nearly 1200 grains of ionizable salts from raw water, which is more than twice the former capacity. For example, from raw water of 4 grains per gallon total solids content,

Cleaning Steel Parts...


Parts for Heat Treating
Parts for Enameling
Magnus Aja-Dip Cleaning Machine and 94 XX
Magnus Hot Dip Tank and Water
Magnus Hot Dip Tank and Water
Magnus Hot Dip Tank and Weak Phosphoric Acid
Magnus Drying Oven
Magnus Hot Dip Tank and Weak Chromic Acid
To Heat Treating
To Enameling Dept.
This MAGNUS Equipment Set-Up
Cuts Costs 50%... Boosts Production 900%!

Parts Cleaned — Elements of metal toys, wrenches, shears, hammers, etc.

Dirts Removed — Removing oil and drawing compounds. Some parts are enamelled after cleaning. Others have to be heat treated.

Former Method — Vapor degreasing. It was necessary to hand wipe parts that had to be enamelled.

MAGNUS Method — See flow chart above.

Comparison — Parts are cleaner than with former method. Costs are 50% under former method, due to faster cleaning and elimination of all hand work. Production is 10 times that of former method. User in his report stresses elimination of toxic fumes.

There is a combination of Magnus Aja-Dip Cleaning Machines and Hot Dip Tanks (with or without dryers) which will put your metal cleaning operations on a more flexible, more economical and much more favorable production basis. This is particularly true if you are dependent to any degree on hand work.
We'd like to suggest a set-up suited to your needs!

MAGNUS CHEMICAL COMPANY • 11 South Ave., Garwood, N. J.
IN CANADA—MAGNUS CHEMICALS, LTD., 4040 Rue Masson, Montreal 36, Que.
Service representatives in principal cities

IN METAL CLEANING IT'S Magnus
CLEANERS • EQUIPMENT • METHODS

BETTER-THAN-USUAL SERVICE

with

HENDERSON

WOOD TUMBLING BARRELS

- BEST GRADE MAPLE or other woods to specification
- GREATER THICKNESS for longer life
- QUALITY FABRICATION by skilled and experienced workmen

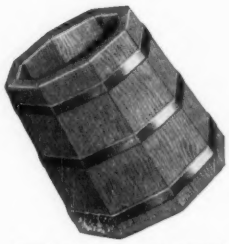
A SIZE AND SHAPE FOR EVERY PURPOSE

8 to 14 sided barrels — 14″ to 38″ in diameter
Round barrels — all sizes
Horizontal barrels — various shapes and sizes

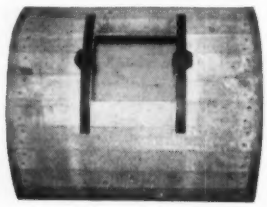
SPECIAL BARRELS

Where finishing specifications call for a different type barrel, Henderson Bros. is prepared to construct special equipment for practically any purpose.
ALSO barrels in steel, stainless steel, brass, Monel Metal and other alloys.

Large sided wood barrel



Small sided wood barrel



Horizontal wood barrel

Round wood barrel

SINCE 1880 DESIGNERS and BUILDERS of Tumbling Equipment

THE HENDERSON BROS. COMPANY
135 S. LEONARD ST., WATERBURY, CONN.

the new output is about 275 gallons per cartridge as compared to the former output of 125 gallons, according to the manufacturer.

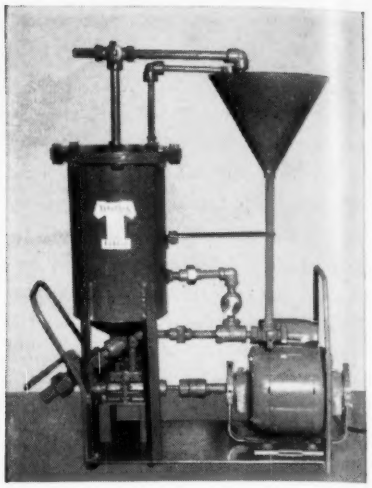
The Bantam Demineralizer is suitable for either bench or wall mounting, and is furnished complete with removable pedestal, closely-adjustable water control valve, and a drain valve to empty cartridge before removal. Other features are a positive-acting indicator to show when to change cartridges and a built-in regulator to adjust the indicator for your exact voltage. A length of pure rubber tubing for delivery of the demineralized water is supplied, also a flexible 4 foot copper pipe with fittings for permanent connection to water piping. Flow rate is 5 to 8 gallons per hour.

Portable Filter for Smaller Plants

Titeflex, Inc., Dept. MF, 546 Frelinghuysen Ave., Newark, N. J.

A small, compact, portable filter has been developed by the above firm for the filtration of chemical solutions with a minimum initial expenditure and no replacement cost. Known as Model L50E, it is 17 inches long by 8 inches wide by 26 inches high and weighs approximately 70 pounds. It is available in stainless steel, brass, iron and Saran, with rubber lined tanks, and can be used on any chemical solution, it is claimed. This model has a small positive displacement pump rated at 275 gallons per hour and powered by a ⅓ hp motor.

This unit can easily be carried from



tank to tank for batch work or can filter continuously on a specific tank, is self-cleaning (does not have to be taken apart for cleaning), and requires no parts, such as bags, sheets, or pads, according to the manufacturer. Model L50E has all the advantages of simplified operation, thorough and quick cleaning, and all the economical features possessed by large Titeflex filters, it is claimed.

Improved Plating Barrels

Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

In December 1947, a new catalog was issued by the above firm describing their complete line of Mercil Barrel Plating equipment. Since that time, numerous changes and improvements have been made which are described briefly below:

RUBBER LININGS

Rubber linings have been supplied in the past in sprayed or vulcanized form. Vulcanized rubber is again available and is recommended for rubber-lined tanks.

TANKS

Two overflow outlets are now provided. In each corner the dam overflow is depressed 3″ so that the solution level is now about 6½″ instead of 3½″. This facilitates disposal of rinse water.

Width of tanks has been increased, and additional ⅛″ of rubber is placed on face of overflow for further protection.

Hangers in rubber-lined tanks are equipped with stop collars on the hanger pins so that when the hanger is set in position in the saddles, the lower part of the drive hanger will

project into the tanks and the hanger will clear the overflow when it is lifted in and out of the solution.

Flexible Dangler Contacts

Single and double flexible dangler contacts have been used to advantage on certain classes of work. Where flexible dangler contacts are supplied no metal trunions are needed and the cylinder rotates on Merlon bushings.

Rubber Cylinders

Prior to World War II, rubber cylinders were furnished with green rubber parts that stood up well. When the war started the rubber manufacturers were forced to use a black synthetic rubber, which was brittle and did not give the service of the prewar rubber.

Now green rubber parts have become available and all rubber cylinders are being furnished with this material.

Monel Cylinders

Monel cylinders will now be furnished with monel shafts, hanger arms and gears as this alloy has been found to be much more satisfactory for parts in contact with acid solutions than phosphor bronze which was formerly used.

Oblique Plating Barrels

Instead of a bushing on the drive shaft there are roller bearings which strengthen the barrel and at the same time eliminate the possibility of shaft wear. The gear housing has been redesigned so that two gears and an idler shaft have been eliminated. Cylinders now have a vulcanized rubber covering instead of sprayed rubber. A new channel base gives greater stability and strength.

High Speed Acid Copper Bath

Dayton Bright Copper Co., Dept. MF, 1030 Valley Street, Dayton 4, O.

An improved acid copper bath which makes possible plating speeds up to .001 inch in 10-15 minutes, and which

BUFFING COSTS

Reduced 75%

AUTOMOTIVE HARDWARE

PROBLEM: The plating operations of a nationally-known producer of automotive hardware were resulting in nearly 100% rejects which required a separate buffing operation after the nickel plating cycle. In addition, solution maintenance costs were excessive and the desired .0005 copper plating thickness was not being achieved.

SOLUTION: Converting to Daybrite provided a smoother, brighter copper, with resultant better finish after nickel plating, eliminating three of the four buffers formerly required—a savings of 75% in buffing costs. Solution maintenance costs were reduced approximately 80% and plating thickness of .0005 to .0007 is regularly achieved without increasing plating time.

USING **Daybrite**

THE IMPROVED ACID COPPER BATH

• You'll double plating speed—and reduce plating time and costs—with Daybrite, the improved acid copper bath. Daybrite provides smooth, dense deposits which tend to fill out minor defects in the base metal, simplifying or eliminating buffing operations and increasing corrosion resistance per given thickness. Proved in service under the most exacting conditions, Daybrite can help you save time and money on your plating operations. Complete information is available . . . write today, outlining your plating requirements.

✔ CHECK THESE DAYBRITE ADVANTAGES:

FASTER PLATING—Plating speed up to .001 in 10-15 minutes.

NO VENTILATION REQUIRED—No objectionable fumes or odors.

ROOM TEMPERATURE BATH—No hot solutions used with Daybrite.

REDUCED MAINTENANCE COSTS—Daybrite replacement chemicals cost less.

SAFER, CLEANER—No cyanide is used in Daybrite; deposits require no activation.

COMPLETE SERVICE—From analysis of your plating requirements to final installation and job set-up, Daybrite service is complete.

Daybrite is adaptable to electroforming operations, particularly in the recording industries, where Daybrite's inherent fine grain and tensile properties are especially beneficial.

DB

Dayton Bright Copper Company

1030 VALLEY STREET • DAYTON 4, OHIO

SPARKLER
horizontal plate
FILTERS

SPARKLER horizontal plate FILTERS

Good Plating Requires
Clean Plating Solutions

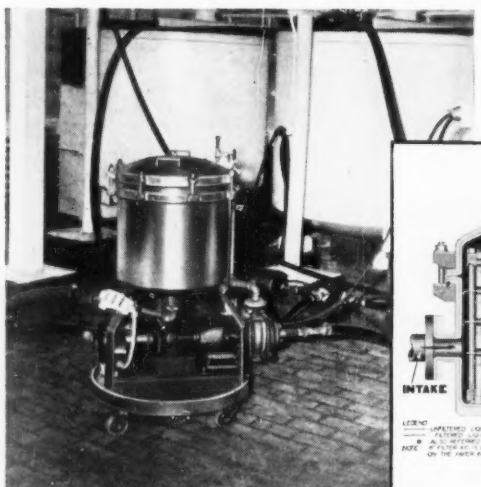
Sparkler Horizontal Plate Filters effectively remove all solids and precipitates from plating solutions—provide positive assurance that solutions are free from undesirable matter.

The horizontal plate principle used by Sparkler makes possible the formation of firm, stable filter cakes that will not slip or crack under intermittent or continuous flow. Flow through the filter is always *with* gravity, and filter aid is floated into position, forming a firm cake of even thickness.

The accompanying photograph shows a typical Sparkler installation in a modern plating plant. Previously, in this plant, silver chloride slurry was shoveled into crocks and laboriously washed by decantation. Now, chloride is mechanically agitated, collected, and washed in the Sparkler filter. Cost of the operation has been sharply reduced and quality of the chloride has been greatly improved.

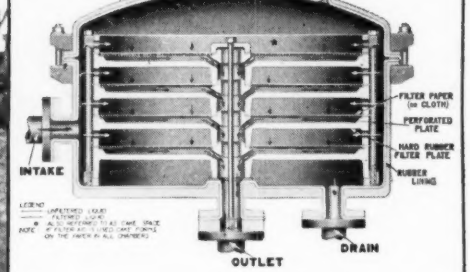
Filters are pressure-tight and leakproof, and are available in rubber-lined construction, stainless steel, or iron. Capacities from 60 to 10,000 G.P.H.

Our Engineering Service is available for your specific problems.



SPARKLER MANUFACTURING CO.
MUNDELEIN, ILLINOIS

This Sparkler Filter is used by a large silverware manufacturer in connection with the plating of silverware.



eliminates the faults inherent in the original method, has been developed by this firm.

The Daybrite method, as it is called, employs no cyanide or hot baths and, because it gives off no offensive fumes or odors, requires no ventilation. The smooth, dense deposits tend to fill out minor defects in the base metal, increasing corrosion resistance and simplifying or eliminating buffing operations before the nickel plating cycle, thus reducing polishing time and costs, it is claimed. Daybrite is also suited to applications in electroforming operations, particularly the recording industry, where its inherent fine grain and tensile properties are especially beneficial.

Complete installation service is available through the company and its representatives, insuring correct application of equipment and operating techniques to provide the maximum benefits possible under the improved plating method. Details are available upon written request.

Combination Cleaner and Phosphate Coating Compound

Detrex Corp., Dept. MF, Detroit 32, Mich.

A new cleaning and phosphate coating material for use on steel and other ferrous metals to provide a fine base for paint coating, has been placed on the market by the above firm.

This material, known as "Detrex 79," is a yellow, non-corrosive cleaning compound in dust-free powder form. It is used in heated water solutions at low concentrations for the production of a light crystalline phosphate film on metal parts.

This combination of efficiently removing light soils and oil films and at the same time depositing the tightly adhering phosphate coating on the cleaned base metal is obviously of advantage in reducing cost, time, and number of operations in a production set up.

No special equipment is required for the application of "Detrex 79," as the solution may be used in open tanks or continuous washing machines, especially of the spray type—either single or multiple stage. The coating is done in a minimum of time and space requirements for equipment. In addition to be fast, it is economical and safe (there are no fumes or other hazards), it is claimed. The time required in either mechanical or still tank processing is one minute spray contact or immersion for a desirable phosphate coating.

The parts come from the process with a clean water-wet surface that dries to a typical uniform blue-gray finish, either in the air or a blow-off stage following the cleaning-coating process.

Salt spray tests show exceptional rust inhibition properties in painted surfaces that have been pre-treated with "Detrex 79," it is said. It also provides a surface which gives better adhesion when paint is applied.

While chromic acid is widely used in industry after phosphate treatment, its use after "Detrex 79" treatment is optional. Extensive field tests have not revealed the need for the chromic acid treatment, according to the firm.

Water Soluble Buffing Rouges and Tripoli

Apley N. Austin Co., Dept. MF, 75 Federal St., Boston, Mass.

The above firm announces a line of buffing rouges and tripoli that are easily dispersed in the cleaning operations prior to plating, insuring top quality plating results. Eliminates the troublesome and costly hand cleaning

operations often required on recessed parts using ordinary compounds that pack and lodge in the depressions. While this ease of cleaning is of paramount importance, the excellent cutting and coloring properties of these materials is also outstanding, according to the manufacturer. Five grades of Red Rouge are available in various cutting or coloring abilities, and all are easily removed from the work in ordinary cleaning baths. It is claimed that in many cases the degreasing operation has been entirely eliminated after buffing with Solubar compounds.

Further details are available by writing to the firm at the above address.

New Iridite Finish

Allied Research Products, Inc., Dept. MF, 4004 E. Monument Street, Baltimore 5, Md.

This firm has announced a new Iridite Bright dip designed especially for use in automatic zinc plating installations. A variation of standard Iridite Bright, this new formulation makes it possible to obtain a bright chromate coating using as few as only three stations after plating: rinse, Iridite, and rinse, followed by the usual drying methods. The coating permanently brightens zinc, resists stains, and offers good corrosion resistance, it is claimed. The degree of brightness and corrosion resistance can be easily controlled by the operator.

One of the novel features of this new Iridite coating is the use of nitric acid, along with an equal part of Iridite Bright concentrate, to replenish the working solution and keep the pH at proper operating levels.

The salt spray corrosion resistance obtained under production conditions is normally 24 hours to 48 hours for the bright, clear Iridite film, increasing upwards to 100 hours as iridescence is increased, it is said.

Cost figures under production conditions are showing a 50% reduction in cost over standard Iridite Bright film, it is claimed.

Vapor Degreasers

Special Chemicals Corp., Dept. MF, 30 Irving Place, N. Y. 3, N. Y.

This firm announces a new completely automatic vapor degreaser incorporating a hot liquid phase, a vapor phase, and a spray rinse phase all in the one unit. Thermostatic controls and indicators are an integral part of the equipment, and Monel heaters give long life to the heating units. Both trichlor and perchlorethylene can be used in the unit, which is coated with sprayed zinc for extra corrosion resistance. All units can be supplied for either AC or DC operation at various voltages, and are supplied ready wired for immediate use. Further information gladly supplied on request.

Metal Cleaners and Conditioners

Klem Chemicals, Inc., Dept. MF, of Dearborn, Mich.

Two new metal conditioners that feature new developments in Phosphoric Acid Cleaners have been announced by this firm. The products are known as Rust-Sol No. 123 for wash-off or immersion type of cleaning and Rust-Sol No. 113 for wipe-off or hand application. Both cleaners feature exceptional wetting and dispersion qualities. They emulsify all oil and grease and penetrate the oil coating to the steel surface where they dissolve all rust and oxide with a reaction that leaves a protective Iron Phosphate Coating, it is claimed. Welding flux, soldering acids and other corrosive salts are dissolved and neutralized by these two new cleaners, according to this firm.

Other features are—safe, non-hazard cleaning that can be used anywhere in the plant on any parts, no matter what the size—eliminates the necessity of dangerous, explosive solvent cleaning

TODAY'S BEST BUY

for Setting Up POLISHING WHEELS AND BELTS

GRIPMASTER PATENTED POLISHING WHEEL CEMENT

LEADING PLANTS REPORT:

GRIPMASTER BOOSTS POLISHERS' PRODUCTION AN AVERAGE OF 47% MORE PIECES PER HEAD!

Now! **Longer Wheel Head Life!** Thanks to Gripmaster's special high-heat resisting ingredient!

Now! **Fewer Stops for Wheel Changes!** Gripmaster *locks in* grains of emery "vise tight!"

Now! **Inventories Simplified!** One grade grips *all* grains—300 to 20. No special sizer needed!

Now! **Better Finishes!** Greater flexibility gives more and finer "breaks" when wheel is "cracked!"

Now! **Goodbye to S. O.!** There's no Stockyards Odor in Gripmaster. It's clean, odor-free!

"First Choice of the World's Best Finishers"

YOURS FOR THE ASKING

GRIPMASTER DIVISION
NELSON CHEMICALS CORPORATION
12345 Schaefer Hwy, Detroit 27, Mich., U.S.A.

IN CANADA:
H. C. Nelson Chemicals, Ltd.
Windsor, Ontario

☐ Send us a generous FREE SAMPLE of Gripmaster.
☐ Send us data on how to boost polishing production.
☐ Have a representative call to demonstrate.

COMPANY _____

ATTENTION _____

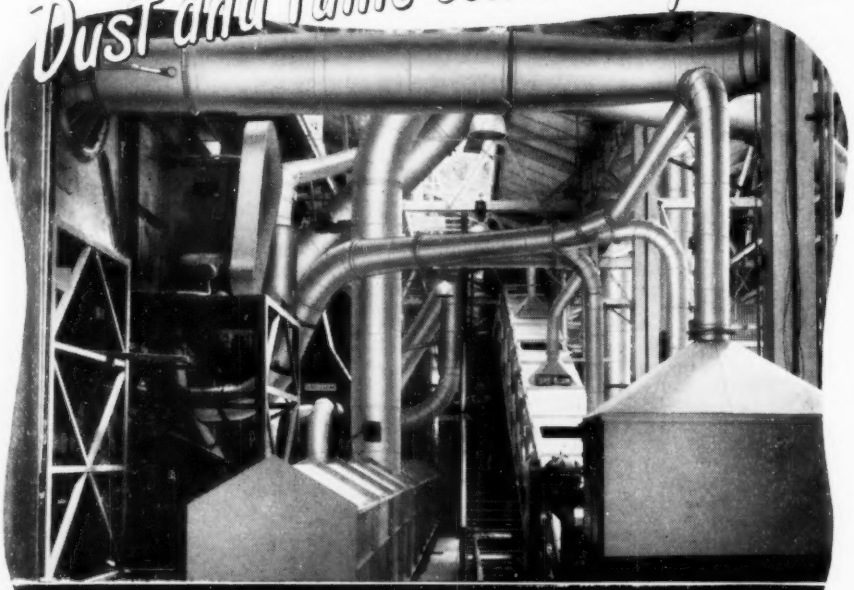
ADDRESS _____

CITY _____ STATE _____

MF 149

Famous implement manufacturer selects KIRK & BLUM

Dust and Fume Control Systems



In the large photo, two mold cooling conveyors are shown to left and right of stairway.

ON THE mold cooling conveyor . . . over the production line shakeouts . . . on snagging and grinding machines and at other points in this modern foundry, you'll find KIRK & BLUM Dust and Fume Control Systems. Each was designed to help make this foundry as clean as any in the industry . . . "a good place to work."

Shown above are two views of KIRK & BLUM Dust and Fume Control Systems which provide "Clean Air . . . the invisible tool" in this plant of one of the world's largest farm implement manufacturers. Note the efficient piping arrangement, installed to AFA standards.

Write for booklet, "Dust Collecting Systems in Metal Industries," yours for the asking. The Kirk & Blum Mfg. Co., 2859 Spring Grove Ave., Cincinnati 25, Ohio.

FOR CLEAN AIR . . . THE INVISIBLE TOOL

KIRK AND BLUM

DUST AND FUME CONTROL SYSTEMS

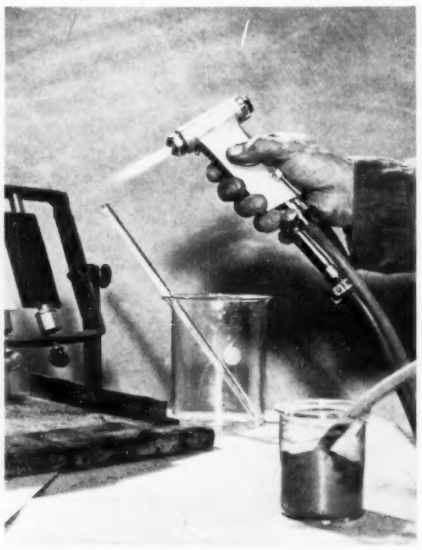
as well as expensive chlorinated degreaser installations—improves the paint bond and paint life over 100%.

Both of these Rust-Sol Cleaners are economical to use, it is said. Rust-Sol No. 123 performs at dilutions of 3 to 4 parts of water. This same cleaner used at approximately ½ of 1% by volume can be used as a rinse after alkali stripping to provide a positive base for painting. Rust-Sol No. 113 works with dilutions containing 2 to 3 parts of water. It is non-toxic, non-inflammable and non-corrosive.

Powder Flame Spray Pistol

Schori Process Div., Ferro-Co. Corp., Dept. MF, 8-11 43rd Rd., L. I. City, N. Y.

The spread of atomic research and development throughout the country has created a need for a quick, inexpensive method of laying down films of new materials. Recognizing this need, the Schori Process Division has developed and is now manufacturing a laboratory size flame-spray powder pistol which sprays any metal or plastic powder or combinations of metal and plastic powders. This flame-spray pistol, which also can be used for heating, soldering and brazing, meets the needs of these laboratories so well, and is so easy to use, that the manufacturer feels that almost every laboratory in the country will want one. The manufacturer is therefore geared for production and is able to sell these pistols at a nominal price.



Emulsion Cleaner

The DuBois Co., Dept. MF, Cincinnati 3, Ohio.

Mul is a ready-to-use emulsion cleaner which combines solvent and emulsion cleaning with the synergetic action of soil penetrating agents. These prepare waxy and greasy buffing and grinding compound ingredients for removal by the emulsion.

Unlike ordinary emulsions, Mul strongly resists hard water attack and minimizes curd formation, and is inhibited against foaming even in the highest pressure washers, according to the manufacturers.

For interim rust inhibiting MUL is recommended for use in one-stage washers, as an additive to rinse tank, and as a dip. It gives positive and longer rust inhibiting, because it depends upon inherent corrosion inhibitors and not on mere surface filming, it is claimed.

This product is Safe, Non-toxic, has a high flash point, gives off no objectionable odors, is non-corrosive, and may be used on any metals and soft or painted parts, according to the firm.

Mul is recommended for:

1—Emulsion cleaning in industrial washers, using 1 gallon of Mul to 50 gallons of water for medium-heavy cleaning, less for light work, more for special cases.

2—For wipe-down maintenance cleaning in factories, shops, roundhouses, truck depots, marine ways, etc.

3—For interim rust inhibiting during production and short time storage periods.

4—For pre-wetting before alkaline cleaning or vapor degreasing.

Business Items

New Maker of Buffing Compounds

A new manufacturer of buffing compositions, who offers direct factory service to firms in eastern Ohio and western Pennsylvania, has begun operations in Emsworth, Pa. The new supplier is the *Schaffner Manufacturing Co.*

It is under the direction of *Paul E. Schaffner*, formerly associated with the McAleer Mfg. Co. of Detroit for over ten years. The entire production staff has a background of many years' experience in the buffing and polishing field.

Schaffner Manufacturing Company specializes in nickel (lime) finish and grease polishing compounds and is equipped to make these items to customers' specifications.

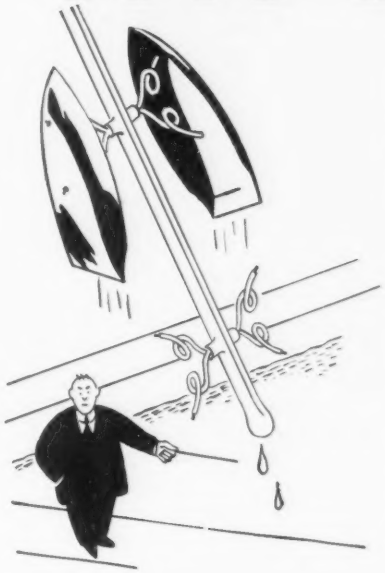
Gerell Mfg. Co. Moves to Cleveland

The *Gerell Manufacturing Co.*, formerly of Elyria, Ohio, specialists in the manufacture of polishing and buffing compounds, have announced the moving of their plant, warehouse, and general offices to 3521 *King Ave., Cleveland* 14, *Ohio.*

Wyandotte Representatives Receive 25-Year Awards

Thirteen sales representatives of the *J. B. Ford Division* of *Wyandotte Chemicals Corp.* recently received gold watches commemorating 25 years of service to the company and its customers. This brings to 1,342 the total number of Wyandotte Chemicals employees who have won quarter century honors. Of this total number, 82 watch award men and women are members of the J. B. Ford Division of Wyandotte Chemicals. *E. M. Ford*, president of the firm, made the presentation.

RACK COATING CUTS DRAGOUT



Unichrome Coating 218 permits company to set up continuous cycle of chromium!

By using Unichrome Coating 218, this well-known producer of brass products has now been able to eliminate reracking! They now use the same rack for copper, nickel and chromium without fear of dragging chromic acid into the nickel!

This accomplishment is due, first, to Coating 218's high gloss and smoothness—which contribute to its free-rinsing qualities. It is due, secondly, to the remarkable resistance of Coating 218 to severest plating baths and rough handling—no chipping, blisters or breakdowns to trap and drag over contaminants. Investigate this green, plastisol, baking coating for the many *other* advantages it also offers you. Write for details.

NO BAKING OVEN? Get the benefits of Coating 218 by sending your racks to coating applicator nearby who is set up to apply it. We'll send you his name.

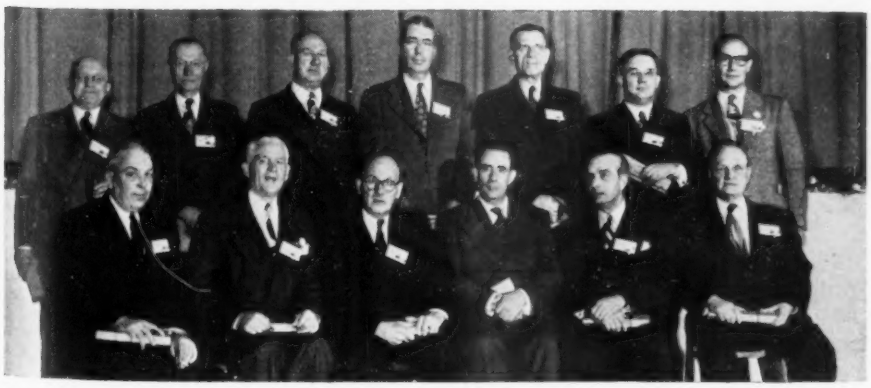
UNICHROME

Trade Mark Reg. U. S. Pat. Off.

RACK COATINGS—Products of

UNITED CHROMIUM, INCORPORATED • 51 E. 42nd St., New York 17, N.Y.

Detroit 7, Mich. • Waterbury 90, Conn. • Chicago 4, Ill. • Dayton 2, Ohio • Los Angeles 13, Cal.



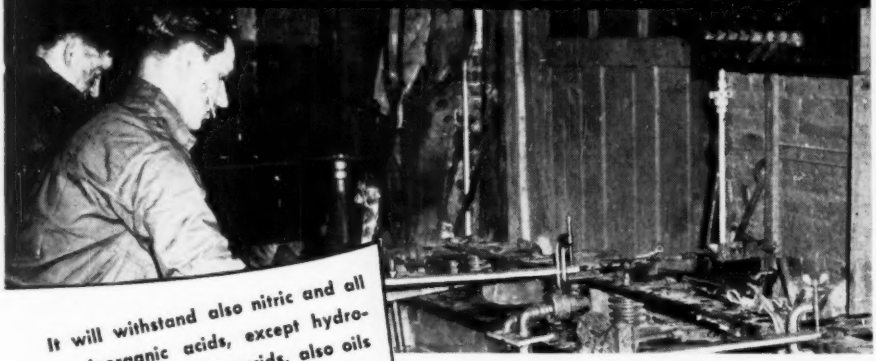
The Wyandotte Representatives shown here recently received gold watches to commemorate 25 years of service to users of cleaning and processing materials. Front row, left to right: L. R. Horne, Boston; G. D. Caffrey, New York; V. R. Jones, manager Food and Beverage Department, Wyandotte; Carter B. Robinson, Vice president—sales, J. B. Ford Division, who completed 25 years in 1942; F. A. Kilpatrick, San Francisco; and C. R. Beaubien, Detroit. Second row. B. J. Rosenthal, Minneapolis; P. B. Johnson, Kansas City; A. A. Bettner, Milwaukee; Tom Blair, Wyandotte; M. W. Millard, Toronto; J. A. Troxell, Dayton and B. B. Baker, Portland. Absent when photo was taken: R. B. Cosgrave, Fort Wayne.

Victor Chemical Makes Personnel Changes

Three changes in the organization of the *Victor Chemical Works*, 141 W. Jackson Blvd., Chicago, were announced today by *Rothe Weigel*, Executive Vice-President.

Mr. William R. Dedert has been appointed to the new post of general

This Tank HANDLES CHROMIC ACID AT HIGH TEMPERATURES... and Asks No "TIME OFF"!



It will withstand also nitric and all other inorganic acids, except hydrofluoric — most organic acids, also oils and solvents • The steel shell has ZEROK* resin lining, protected with 4" of acid-proof brick joined with VITREX, a cement immune to temperatures up to 1600° F. — and to any acid concentration.

*ZEROK is proof also against alkalis. May be had too, as a paint, applied with brush or spray.

Tanks and floors, also disposal and neutralization units built of Atlas materials and to Atlas design, are proof against, not merely "resistant to" any given corrosive or group of corrosives, as well as against solvents, steam and high temperatures • Atlas Construction is extra rugged, resists extraordinary mechanical punishment, serves for years without "down time" or maintenance cost.

Tank exteriors and structural members of wood, steel or concrete are adequately protected against corrosion by Atlas acid-proof coatings, applied with brush or spray • Our engineers, with wide acid-proofing experience in the metal working and chemical industries, as well as in other fields, will gladly study your corrosion problem, make recommendations and submit plans and estimates — without obligation. Contact our nearest branch — and write us at Mertztown for Bulletin M3–1

THE Atlas Mineral Products Company of Penna.

THE ATLAS MINERAL PRODUCTS CO. OF TEXAS INC., Box 252, Houston 1, Tex.

*BERKELEY 2, Calif., 605 Addison St.
DALLAS 5, Tex., 3921 Purdue St.
*DENVER 7, Colo., 1921 Blake St.
*HONOLULU 2, Hawaii, U. S. A.
OMAHA, Neb., 423 South 38th Ave.
*LOS ANGELES 12, Cal., 172 S. Central Ave.
*SEATTLE 4, Wash., 1252 First Avenue, S.
*Stock carried at these points

MERTZTOWN
*ATLANTA 3, Ga., 452 Spring St., N. W.
*CHICAGO 1, Ill., 333 No. Michigan Ave.
*DETROIT 2, Mich., 2970 W. Grand Blvd.
NEW YORK 16, N. Y., 280 Madison Ave.

PENNSYLVANIA
PITTSBURGH 27, Pa., 4921 Plymouth Rd.
PHILADELPHIA, Pa., 355 Fairview Rd. Springfield, Pa.
ST. LOUIS 5, Mo., 7603 Forsythe Blv'd.

IN CANADA: Atlas Products are manufactured by H. L. BLACHFORD, Limited. 977 Aqueduct Street, Montreal 3, P. Q., 86 Bloor St. W., Toronto, Ont.

superintendent. In this capacity he will be in charge of manufacturing operations at the Chicago Heights, Illinois and Nashville, Tennessee plants, and the company's newest plant at Morrisville, Pennsylvania.

Mr. Homer B. Terry, formerly superintendent of the Nashville, Tennessee plant, succeeds Mr. Dedert as superintendent at the Chicago Heights, Illinois plant.

Mr. John A. Coben, previously general foreman at the Nashville plants, succeeds Mr. Terry as superintendent at Nashville.

Oldroyd New Industrial Sales Manager for Oakite

Announcement has been made by *Oakite Products, Inc., New York*, of the appointment of *Frank L. Oldroyd* as Sales Manager of its Industrial Division.

Mr. Oldroyd has been associated with the Oakite organization in the servicing of its specialized industrial cleaning and allied materials for over fifteen years, having spent eleven of these years as an Oakite field service territorial representative in various sections of the country. Subsequent promotions found him acting in the capacity of Division Manager in the company's divisional offices in Atlanta and Chicago for a period of two and one-half years, then as special Field Sales Manager for a year prior to his most recent appointment.

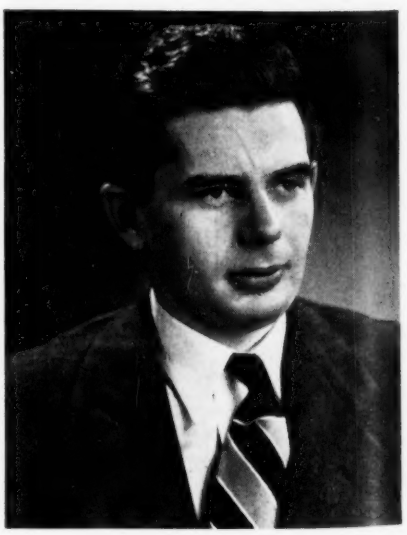
Mr. Oldroyd has already assumed his new duties and will direct the activities of Oakite's nationwide industrial field staff from the company's general offices in New York.

Frank L. Oldroyd

Pennsalt Adds to Chemical Research Staff at Whitemarsh

The appointment of *Hyman Iserson* and *Maurice E. Miville* as research chemists at its Whitemarsh Research Laboratories has been announced by *Dr. W. A. LaLande, Jr.*, Director of Research and Development, *Pennsylvania Salt Manufacturing Co., Phila., Pa.*

Mr. Iserson, a native of New York City, attended New York public schools. He received his bachelor of science degree at the College of the City of New York and his master's degree at Temple University. He formerly worked as a research chemist for Frankford Arsenal and Rohm and



Hyman Iserson

Maurice Miville

Haas. He is a member of the American Chemical Society and the Organic Chemists Club of Philadelphia.

Mr. Miville was born in New Hampshire and was educated in Merrimack, N. H., public schools and the University of New Hampshire where he received his bachelor of science degree in chemistry. A veteran of World War II, he served with the Army in Europe. Mr. Miville is a member of the American Chemical Society. He formerly was employed by the Celanese Corporation of America.

Nox-Rust Appoints Sales Manager

Nox-Rust Chemical Corporation, 2429 So. Halsted Street, Chicago 8, Ill. announces the appointment of *Ray H. Stuff* as Sales Manager of their rapidly expanding Nox-Sound Division. Mr. Stuff has had extensive sales management experience. He became associated with the Stoker Sales Division of Fairbanks, Morse & Co., in 1936. Then advanced to the position of Sales Manager of a specialized division of the A. O. Smith Corporation, Milwaukee, in 1945. Mr. Stuff is experienced in marketing, advertising and product control, and in his new position with Nox-Rust will create a national sales force to give more effective distribution to their present products and provide a sales organization for the many new items in their expanding activities.

Ray H. Stuff

YOU CAN HAVE

All the advantages of the new Plastisol type of insulation at a surprisingly low cost per rack. Paste type insulation is a 100% solids dispersion of the finest synthetic resins. The Paste is thick enough so that a single dip makes a very thick coating. Then a quick oven bake to convert the mass into an almost permanent insulation that will last for months. So quick to do and so little labor cost makes Paste the preferred insulation for all types of racks for every plating service.

REAL PROTECTION

BUNATOL No. 1000 is a thick red fluid Paste that fulfills every rack insulation requirement. It has excellent adhesion and provides a thick single dip coating that rinses freely, does not affect any plating solution, stands up in all cleaners except degreaser, and does not carry over solutions. Use it on plating racks, anodizing racks, anode baskets, dipping baskets and work fixtures. The actual cost is low and handling is simple. Let us give you the facts.

NELSON J. QUINN COMPANY
TOLEDO 7, OHIO

ON YOUR RACKS

Manhattan Rubber Division Completes Fifty-Fifth Year

On October 28, the *Manhattan Rubber Division* of *Raybestos-Manhattan, Inc., Passaic, N. J.*, completed its fifty-fifth year.

Manhattan traces its ancestry to the dawn of the rubber industry, to the first chartered rubber company in America, the Roxbury Rubber Co. of Boston. It was organized in 1833, six years before Goodyear used sulphur to vulcanize rubber, and in 1845 the Roxbury Co. was reorganized by *Henry Fowle Durant*, founder of Wellesley College, and *John Haven Cheever*, who became joint owners of the Boston Belting Co. and another rubber company. Durant placed his two cousins in the company. One was *Frank Cazenove Jones*, the other *Col. Arthur Farragut Townsend*, godson of Admiral Farragut.

In 1893, *Mr. Jones, Col. Townsend* and *George Woffenden*, then considered top-ranking rubber expert,

When it comes to specifying a rust-resisting or friction-reducing chemical finish for a production run of steel parts, whatever they may be, there are many advantages to selecting Du-Lite, particularly if you want to avoid trouble and keep production up to schedule.

Du-Lite produces on all steel and steel alloy parts except stainless a handsome, uniform jet black finish. Not a coating, Du-Lite becomes an integral part of the steel surface itself and will not chip, peel, crack or blister.

Imposed at non-critical temperature, Du-Lite causes no dimensional change in the parts treated. The process is simple to operate and inexpensive to install.

To guarantee the success of every Du-Lite installation there is available a trained, technical representative in your area who will get you started and find the "workable" answers to every problem that arises.

DO IT RIGHT WITH DU-LITE

While matching or excelling in every respect any other process for the chemical blacking of steel, Du-Lite remains less costly to operate than most. Do it right with Du-Lite . . . write or phone today.

WRITE or PHONE TODAY to

The DU-LITE CHEMICAL CORP.
110 RIVER ROAD :-: MIDDLETOWN, CONN.

founded The Manhattan Rubber Mfg. Co. with a newly built plant at Passaic. Mr. Jones became first president but retired in 1903 in favor of Col. Townsend, who served as president until 1929 when the company merged to form *Raybestos-Manhattan, Inc.*

Today Manhattan Rubber Division is one of the largest manufacturers of mechanical rubber goods, including conveyor and transmission belting, V-belts, hose, molded goods, packing, rubber covered rolls, rubber lined tanks; also brake lining, abrasive wheels, and bowling balls. About 4,000 persons are now employed at the plant that covers more than a million square feet of floor space.

Raybestos-Manhattan, Inc., has other time-honored divisions: The Raybestos Division at Stratford, Conn., the country's largest friction material plant and first producer of asbestos brake lining, now nearing its half century; United States Asbestos Division, Manheim, Pa., also nearing its half century and one of largest manufacturers of asbestos products, packing, and friction materials; General Asbestos & Rubber Division, North Charleston, S. C., now in its fifty-third year and largest asbestos spinning plant. *Sumner Simpson* is chairman of Raybestos-Manhattan, Inc., and *John F. D. Rohrbach* is president.

Wagner Bros. Appoint Midwestern Representative

Wagner Brothers, Inc., Detroit, Mich., suppliers of metal finishing

Jack Keyes

equipment and materials and manufacturers of Wagner-Tiedeman Electroplating Rectifiers and Flat-Top zinc anodes, announce the appointment of *Jack Keyes* to handle sales and service to plating and metal finishing industries in Detroit, southern and western Michigan and Ohio. Mr. Keyes brings to this field thirteen years practical experience in plating and polishing as superintendent in some of the larger plants in the Middle West. In the past eight years Mr. Keyes has built up a wide acquaintance through a similar sales association with Hanson-Van Winkle-Munning Co.

Black to Head Public Relations for Cooper Alloy

The *Cooper Alloy Foundry Company, Hillside, N. J.*, announces the coordination of all advertising, publicity and public relations activity under the direction of *George Black*, Public Relations Division Manager.

A graduate of Brooklyn College, Brooklyn, N. Y., Mr. Black spent five years as a foreman in the Detail Manufacturing Section of the Glenn L. Martin Co.

Early in 1947, he joined the Nickel Sales Division of The International Nickel Company, where he was engaged in publicity work relating to nickel steels and irons, stainless steels and

nickel electroplating. He has written numerous articles for trade journals concerned with metal processing.

George Black

Mr. Black holds active membership in the American Society for Metals, American Electroplaters' Society, The Electrochemical Society and House Magazine Institute.

Morris to Supervise Buffing Compound Manufacture

Ray Compounds of Chelsea, Mass., announces the appointment of *Vincent A. Morris* as the supervisor in the manufacturing of buffing compounds and as chief service engineer.

Mr. Morris was formerly superintendent for Munning & Munning, Inc., then he was appointed as formulating chemist for the Roberts Rouge Co. He was later employed in the laboratory of Lea Mfg. Co. Mr. Morris has recently returned from the West Coast, where he pioneered in manufacturing buffing compounds for the L. H. Butcher Co. of Los Angeles.

Oakite Holds Annual Technical-Sales Meetings

How recent developments in the field of cleaning and allied procedures are helping industry to combat rising production costs, was the central theme of a series of technical-sales conferences held in New York, Chicago, and Kansas City, during November by *Oakite Products, Inc., Thames St., N. Y. C.*

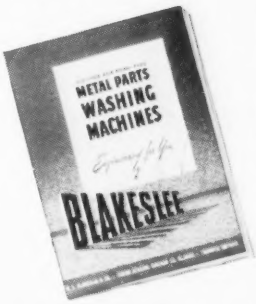
The first of these regional conferences, held at the Hotel Pennsylvania, New York City, incorporated a program of lectures of round-table discussions attended by field service repre-

PAINT REALLY STICKS

WHEN METAL PARTS ARE THOROUGHLY CLEANED IN A

BLAKESLEE

METAL PARTS WASHER



To assure 100% grease free surfaces for subsequent finishes to automobile bodies, refrigerators, washing machines, toys and hundreds of other products, choose a Blakeslee Metal Parts Washer, especially adaptable to the cleaning of metal parts prior to surface treatment. Blakeslee sprays are designed to reach all surfaces and each machine is "tailor made" to do a specific cleaning job. From our experience in handling every metal piece from small watch parts to diesel engine crankcases, we have been able to build a washing machine designed to do a perfect job and to last for years.

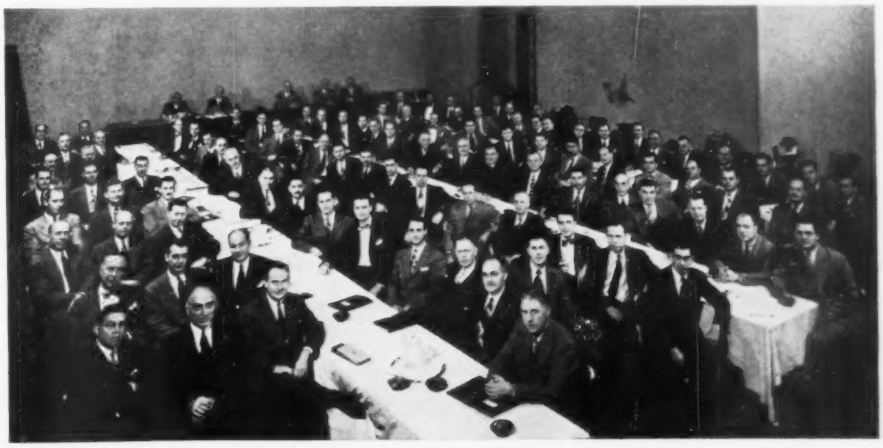
Write for FREE booklet on Blakeslee Metal Parts Washers to answer your particular cleaning problems.

G. S. BLAKESLEE & CO.

BLACOSOLV DEGREASERS AND SOLVENT

NIAGARA METAL PARTS WASHERS

G. S. BLAKESLEE CO., CHICAGO 50, ILLINOIS
NEW YORK, N.Y. TORONTO, ONT.



SUPERIOR FINISHES PROVE THE SUPERIORITY OF *SPEEDIE!*

***SPEEDIE* Stainless Steel and Chrome Compositions**

For fast, economical cutting down and coloring of all types of *stainless steel* and *chrome*, nothing surpasses *SPEEDIE* Stainless Steel and Chrome Compositions. They have been job-proved through the years for cutting down and to give maximum color per degree of cut.

Learn more about the many other *SPEEDIE* "laboratory-quality", job-proved products — Tripoli, Nickel Finish, Satin Finish, Emery Cake, Grease Stick, etc. Write Dept. M. F. for your FREE catalog today.

- CUT AND COLOR IN ONE OPERATION
- FAST, GENTLE CUTTING ACTION
- MAXIMUM COLOR PER DEGREE OF CUT
- CLEANER WORKING — LESS WASTE
- 5 SPECIAL COMPOUNDS AVAILABLE
- ALL 100% SAPONIFIABLE

Polishing Room Supplies and Accessories

BP **THE BUCKEYE PRODUCTS CO.**
7033 Vine Street Cincinnati 16, Ohio
Cable address: Buckprod

Put the **FINGER**
on your
Buffing Costs
USE
CHURCHILL FINGER-BUFFS
—AIR COOLED—
Faster Cutting — Lower Costs
Sole Mfrs.

GEO. R. CHURCHILL CO., INC.
NO. QUINCY 71, MASS.
Under U. S. Patents Nos. 2146284, 2350216. Others Pending.

sentative of the company's New England, New York, Philadelphia, Southern and Canadian sales divisions. Highlighted on the conference agenda were reports delivered by Oakite research chemists, service engineers and technical specialist on latest trends in cleaning and associated materials for the food processing dairy product, metals, petroleum and railway transportation fields. Also discussed were new Oakite materials and equipment to be made available to industry during the coming year.

Similar conferences held at the Hotel Sheraton, Chicago, November 22-24, and the Hotel President, Kansas City, November 29, 30 and December 1, were attended by Oakite field service representatives from the Chicago, Detroit and Central Division, and the Pacific Coast, Midwestern and Southwestern sales territories respectively.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Dayton Branch

The Fourth Annual Educational Session and Dinner Dance of the Dayton Branch will be held at the Miami Hotel, Dayton, Ohio, on February 12, 1949. The Educational Session will start at 1:30 p. m., followed by dinner and entertainment at 6:30 p. m.

Honorary Chairman for the educational session will be *S. S. Johnson*, Supreme President of the A.E.S. These speakers will present papers:

Geo. W. Jernstedt, Mgr. Electroplating Projects, Westinghouse Electric Co., East Pittsburgh, Pa.

Dr. Louis Weisberg, Chairman of A.E.S. Research Committee.

Dr. Ralph Schaefer, Vice Chairman A.E.S. Research Committee and Research Director for the Cleveland Graphite Bronze Co.

Chicago Branch

The November meeting of the Chicago Branch was held at the Atlantic Hotel on Nov. 12th. 125 members and guests attended.

The speaker for the evening was *Mr. E. G. Kominek* of Infilco, who presented a very thorough paper on a vital

subject, "Plating Room Wastes." While the plating industry in the Chicago area may be fortunate at the present time in not being forced to install waste disposal units, we nevertheless should have on hand all available information.

Elected to membership were: *Wilbur L. Berberick*, Apex Plating Co.; *D. K. Olson*, Arnold Schwinn Co.; *R. V. Zullo*, Arnold Schwinn Co.; and *Norman Wagner*, Wagner Mfg. Co.

The December meeting was held on Dec. 10th at 8:00 p. m. in the Atlantic Hotel. This meeting was almost strictly social with color travel movies and refreshments. Ladies were invited to attend.

Grand Rapids Branch

The Eleventh Annual Educational Session and Dinner Dance of the Grand Rapids Branch, AES, will be held on Saturday, January 29, 1949, at the Pantlind Hotel, Grand Rapids, Mich.

The Educational Session will start at 2:00 p. m., and is open to all. *F. S. Johnston*, Supreme President, AES, will be the technical chairman. Speakers and their subjects are as follows: "Levelling of Electro Deposits"—by *Myron B. Diggin*, Technical Director, Hanson-VanWinkle-Munning Co.; Subject to be announced—*Dr. M. M. Beckwith*, Harshaw Chemical Company, Cleveland, Ohio; "What Constitutes A Satisfactory Electro Deposit"—by *Dr. A. K. Graham*, Executive Secretary AES, Graham Crowley Associates.

The Annual Banquet will start at 7:00 p. m. in the main ballroom, and will include a floor show and dancing. Table reservations will be assigned upon receipt of payment for tickets. Make reservations with *Jack Hanney*, 1105 *Dickinson Street, S. E., Grand Rapids 7, Mich.*

Philadelphia Branch

The Annual Educational Session of the Philadelphia Branch was held on November 6, 1948. The session was well attended and featured the following speakers:

1.—*Dr. William Blum*, Electrodeposition Section of the National Bureau of Standards, spoke on the "Interest of the Federal Government in Electroplating." It was pointed out that the Government rendered many different types of services to the various Federal departments and to the public. These include:

A—Preparation of Federal specifications;
B—Development of test methods;
C—Testing plated products for conformance with specifications or other legal requirements;
D—Development or application of special plating processes; and
E—Advice or assistance in operation of plating plants.

A large number of specific examples of these services since 1910 to the present in peace and in war were cited by Dr. Blum.

2.—*Mr. Myron B. Diggin*, Technical Director, Hanson-Van Winkle-Munning Co., spoke on "Leveling of Electrodeposits." Mr. Diggin discussed the specific effects of various methods for leveling, i.e. increasing the smoothness of electrodeposits. Electrochemical methods for achieving leveling are as follows: (1) Electropickling; (2) Electropolishing the basis metal; (3) Electropolishing the deposit; (4) Plating solution composition and operating conditions; (5) Periodic reverse current plating. Examples of each of these methods were fully discussed.

3.—*Dr. Walter R. Meyer*, President, Enthone, Inc., spoke on the "Preparation of Metals for Electroplating." The zincate method for preparing aluminum for electroplating was discussed, including etching and non-etching cleaning procedures, double zincate

CHROMIC ACID

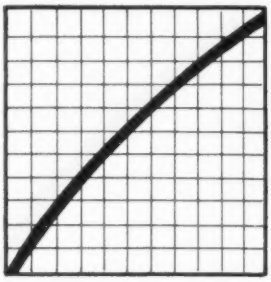
99.75% PURE

With two complete, independent plants at Jersey City and Baltimore, and over a hundred years of technical background, Mutual is the world's foremost manufacturer of Chromic Acid.

MUTUAL CHEMICAL CO. ... NEW YORK
OVER A CENTURY OF CHROMIUM CHEMICAL PROGRESS

Sodium Bichromate
Potassium Bichromate

MUTUAL CHEMICAL COMPANY OF AMERICA
270 MADISON AVENUE NEW YORK 16, N.Y.



NO-CRO-MIST!

WITHIN ONE YEAR NO-CRO-MIST HAS SAVED PLATERS MANY THOUSANDS OF POUNDS OF CHROMIC ACID!

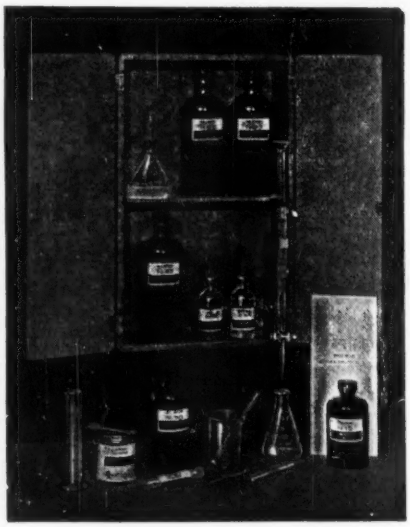
If you can't get all the Chromic Acid you would like, NO-CRO-MIST will make every pound go farther. But saving 95% of the Chromic Acid usually lost in ventilation is not the whole story! NO-CRO-MIST is daily giving hundreds of platers these additional advantages:

1. **Saving a large proportion of building heating costs by allowing reduction in volume of preheated air (within safety codes) lost through chrome ventilation.**
2. **Eliminates fumes from the plating room.**
3. **Keeps busbars, racks, rack carriers and ventilating systems cleaner, saving labor and maintenance and giving better operation.**
4. **Extends operable sulfate ratio, thus simplifying control.**
5. **Actually improves covering power of chrome.**

ORDER 5, 25 OR 55 GALLONS . . . TODAY!

ROHCO

R. O. HULL & COMPANY, INC.
1280 West Third Street
Cleveland 13, Ohio



CHROMIUM NICKEL COPPER

Simple test sets for controlling these and other solutions available.

Write for Literature

KOCOUR CO.
4802 S. ST. LOUIS AVE.
CHICAGO 32

Specify Kocour Sets from your supplier.

dipping and the corrosion resistance of electroplated aluminum. The functions of the various components of commercial metal cleaners were discussed. Specific cleaning procedures for metals were then outlined, including copper, brass, zinc base die castings, and lead alloys.

4.—*Mr. William M. Phillips*, Head, Electrochemistry Dept., Research Laboratories Division, General Motors Corp., spoke on "Comparison of Physical Properties and Field Test Results on Plated Parts." A new method has been developed to indicate the combined effect of stress-strain and brittleness in electrodeposited coatings and this method has been applied to plating metals with minimum stress. An intensive investigation has been made to correlate the thickness and quality of plated parts with actual field test data. These plated parts on automobiles in use are inspected annually in many parts of the United States. The results were given in chart form and discussed in detail.

Twin City Branch

The Twin City Branch of the American Electroplaters Society met on Monday evening, December 6th, in the Lodge Room of the Covered Wagon in Minneapolis. There were thirty-five (35) persons present.

A lecture on the "Practical Points on Nickel Plating" was given to the Branch by *Robert L. Buckley*, Branch Secretary-Treasurer, and a round table discussion of both reports on the subject and question was held, and this was led by *Paul Hesse* of Union Brass & Metal Mfg. Co. There has been a definite interest in the new series of informal discussions held before dinner by the Branch members. The next meeting will be opened with a discussion on chromium plating.

Following dinner, *Frank Ireland*, Branch President, opened the business session and introduced the guests that were present. *Robert H. Peterson* of Twin City Chromium was introduced as a new member and was welcomed.

President Ireland emphasized the importance of obtaining new members in order that we may continue to offer the many services which we have been giving. He advised that he hoped to have at least 100 members by April 1, 1949, the end of the present fiscal year.

With the conclusion of the business meeting, *Wray Schorr*, Branch Libra-

rian, introduced *Mr. Ray West* of Brown Instrument Division of Minneapolis Honeywell, who spoke on "Temperature Control in the Plating Industry." In addition to his talk, Mr. West showed slides which were very interesting.

Saginaw Valley Branch

The Saginaw Valley branch will hold their Charter Presentation Meeting at the McNiven Hotel, Frankenmuth, on Wednesday, Feb. 9th, with dinner being served at 7 p.m.

In addition to the presentation of the branch charter, several talks and a question and answer period will be held by a Board of Experts, consisting of *Dr. R. M. Beckwith*, Harshaw Chem. Co., *Dr. R. Saltonstall*, Udylite Corp., *Mr. Lyman Perry*, Doehler-Jarvis Corp., and *Mr. Earl Stadel*, Geo. L. Nankervis Co. The subjects to be covered will be Copper, Nickel, and Chrome plating, and Diecast Processing and Plating Equipment.

Los Angeles Branch

Glenn Beckwith, superintendent of plating of Automatic Polishers, Los Angeles, delivered a talk on "Electroplating on Aluminum" as the feature attraction on the educational program of the December 8 meeting of Los Angeles Branch of the American Electro-Platers' Society.

Interest in plating on aluminum has been growing widely in Southern California since the end of the war. This fact, combined with the superb choice of a speaker to treat the subject, were instrumental in attracting a meeting attendance of approximately 85 members and guests.

Beckwith has had many years of laboratory and practical experience in plating on aluminum, and presented a 35 minute talk covering briefly such phases as die casting, polishing, cleaning, racking, rinsing and mild cleaning, and the plating procedure that he has found practical at Automatic Polishers.

Indicative of the interest in the subject was the Question-and-Answer period of nearly an hour's duration which followed the conclusion of his talk.

It was announced at the meeting that an article prepared by Mr. Beckwich on plating or decorative coatings on aluminum base materials will be published in a forthcoming issue of *Metal Finishing*.

PERMAG *for '49*

GEAR Your Cleaning Operations to Your Finishing Operations

Perfect metal finishing depends on perfect metal cleaning, and these two operations when closely geared and running smoothly and economically will produce perfect results.

From this list of operations select those requiring more efficient cleaning compounds.

PERMAG is specialized, highly efficient, has served the industry for more than 25 years.

Pre-Soak Compounds
- ☐ TRIPOLI
- ☐ ROUGE
- ☐ STAMPING OIL

Electrolytic Compounds
- ☐ DIE CAST
- ☐ COPPER
- ☐ BRASS
- ☐ STEEL
- ☐ CATHODIC
- ☐ ANODIC
- ☐ AUTOMATIC SYSTEMS

Burnishing Compounds
- ☐ ALUMINUM
- ☐ DIE CAST
- ☐ BRASS
- ☐ HARD WATER

Aluminum Treatment
- ☐ SATIN FINISH
- ☐ ETCHING
- ☐ CLEANING
- ☐ DRAWING

Organic Finishing
- ☐ PRE CLEANING
- ☐ SPRAY BOOTH COATING
- ☐ WATER WASH SPRAY BOOTH ADDITIVE
- ☐ STRIPPING

Check the materials you need that are listed here, and send it to us. Try PERMAG in your finishing department on difficult jobs.

MAGNUSON PRODUCTS CORPORATION

Mfrs. Specialized Cleaning Compounds for Industry

Main Office: 50 COURT STREET BROOKLYN 2. N. Y.

In Canada: Canadian PERMAG Products, Ltd., Montreal - Toronto

DOMESTIC VIENNA LIME

ROCKWELL BRAND

FOR

COMPOSITIONS

STEEL POLISHING

ROCKWELL LIME COMPANY

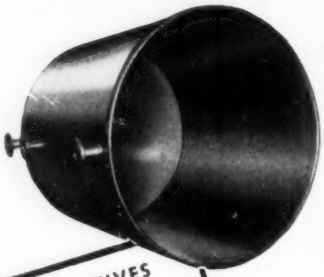
QUARRIES
MANITOWOC
WISCONSIN

OFFICES
228 N. LA SALLE ST.
CHICAGO 1, ILLINOIS

Best Results.. Lowest Cost

ON ALL TYPES OF

TANK LININGS



Years of experience qualify us to handle your specific problem . . . involving the handling of acids, alkalis, aromatic solvents, unsaturated vegetable oils, gases, vapors, etc. Engineered recommendations of Laybond Rubber, Hard Rubber, Neoprene, Koroseal, Phenolics or Ceramics. Our specialized applications include racks and hangers, anodes, pickling tanks, drums, pails, dippers, pipe and fittings, air agitation systems, tank grids and screens, coils and ventilation equipment.

REPRESENTATIVES WANTED . . . plating supply houses . . . acid and chemical companies preferred. A few select areas available. Write for details.

LICENSED APPLICATOR OF GOODRICH KOROSEAL

ACME-FISHER DIVISION
SUBSIDIARY OF
BROADWAY RUBBER CORPORATION
LOUISVILLE 2 Manufacturers Since 1901 KENTUCKY

*PORTABLE RIGS FOR FIELD WORK

"HARRISON AA Buffing and Polishing COMPOUNDS-

STAND OUT!

To make your products stand out competitively, specify HARRISON cake or liquid compounds. Their fast cutting and quick cleaning action insure economy of operation.

SPECIAL: Harrison has developed a new dip compound that creates a head on the buff. You get a deeper cut . . . use less compound . . . save!

At your request, our experienced technical representatives will call to advise you on special problems.

Cement • Buffs • Buffing and Polishing Compounds

HARRISON & CO., INC. • HAVERHILL, MASS.

Now...25% MORE WEAR with NEOX*

Edmont's New, Tougher Coating for Liquid-Proof WORK GLOVES

NEOX, the remarkable new coating for work gloves developed by Edmont, incorporates the long wear of plastic with the resiliant qualities of Neoprene to assure at least 25% longer wear with complete flexibility and comfort. These NEOX coated gloves with the fabric lining set new standards of safety in the handling of materials wet or dry, sharp or abrasive. They fully protect against acids, caustics, oils, greases, and many solvents. Knit-wrist or gauntlet styles.

*Combination Synthetic Rubber and Plastic

See Your Safety Equipment or Industrial Supplier

Edmont Manufacturing Co.
519 ORANGE ST. COSHOCTON, O.

☐ Please send full information and prices

COMPANY NAME .....

ADDRESS .....

CITY ..... STATE .....

ATTEN. OF .....

We shall gladly make recommendations for the most economical style upon receipt of full application information.

Two new members were enrolled at the December meeting. These were *Wallace Francis* of the Francis Plating Co., and *George Moeller* of Spartan Engineering Co.

The following guests were introduced:

Oliver Siedle, S&S Plating Co.; *E. Newham*, Felker Mfg. Co.; *E. L. Yoch*, General Electric Co.; *M. K. McKeon*, Virtue Brass Co.; *Robert L. Hungerford*, *D. H. Day* and *S. R. Morrison*, Modern Plating Co.; *George Moeller*, Spartan Engineering Co.; *Michael Katich*, S. W. Plating Co.; and *Arthur Nieman* and *Charles W. Hollet* of Cannon Electric Development Co.

Two committee appointments were announced by President *Frank Bunker*: *Dean Williams* to succeed *D. N. Eldred* as technical editor of the 1949 Technical Yearbook and Directory to be issued by the Branch in March; and *Earl Arnold* to succeed Sergeant-at-arms *Gil Bishop*, resigned.

Richard Wooley of United Chromium proposed that the branch incorporate as a non-profit organization in conformance with a suggestion from the Supreme Society for such action by the branches. It was moved and adopted that the board of managers serve as a committee to investigate the proposal and report at the next meeting with recommendations for or against.

AMERICAN SOCIETY FOR METALS

Lyman Appointed Associate Editor of Metal Progress

Taylor Lyman, known throughout the metals industry for his editorship of the Metals Handbook, will become Associate Editor of Metal Progress on January 1, 1948.

Announcement of Lyman's appointment as the publication's Associate Editor was made by *W. H. Eisenman*, National Secretary, the American Society for Metals, publishers of both the Metals Handbook and Metal Progress.

Ernest E. Thum, with Metal Progress since its founding in 1930, continues as Editor-in-chief.

Mr. Lyman received his A.B. degree in Engineering from Stanford in 1940. His Master of Science in Physical Metallurgy was acquired at Harvard in 1941, with a Ph.D. (metallurgy) from Notre Dame in 1944. Lyman was an instructor in Metallurgy at Columbia, Illinois Institute of Technology and

Notre Dame, with practical experience as a metallurgist at the Bendix Aviation Corporation during the latter part of the war. He has been with ASM since 1945.

Chicago Electroplaters Institute

At the November meeting, the Nominating Committee was appointed, consisting of chairman *Theron De Mott* and members *Harry E. Delevitt, J. Robert Greenwell, Louis P. Lanz,* and *George Westerberg Jr.* Discussion on the use of the Manual was led by chairman *Zinn.* Vice chairman *Malooly* illustrated a method of figuring prices through the use of a chart that converts the gauge of metal to weight per square inch or square foot. The December meeting has been cancelled, and the next one will be the annual meeting and election of officers and directors on January 20, 1949.

The following company has been accepted for membership in the Chicago Electro-Platers Institute: *U. S. Plating & Mfg. Co., 3559 W. Harrison St., Chicago 24—T. R. Piech, George Loveless.*

AMERICAN CHEMICAL SOCIETY

New Officers Elected

Dr. Ernest H. Volwiler, executive vice president of Abbott Laboratories, North Chicago, Ill., has been chosen president-elect of the American Chemical Society, and will head the Society in 1950.

During 1949 the president will be *Professor Linus Pauling,* chairman of the division of chemistry and chemical engineering in the California Institute of Technology, who will take office on January 1, succeeding *Dr. Charles Allen Thomas,* executive vice president of the Monsanto Chemical Company, St. Louis, Mo.

Dr. Volwiler was elected in a national ballot of the 59,000 chemists and chemical engineers making up the Society. Two new members of the Board of Directors also were chosen. They are *Dr. Ralph W. Bost,* Smith Professor of Chemistry and head of the department of chemistry in the University of North Carolina, who will represent the Society's Fourth District, and *Dr. Henry Eyring,* dean of the graduate school and professor of chemistry in the University of Utah, who will represent the Sixth District.

Dr. Volwiler was graduated from Miami University (Ohio) with the Bachelor of Arts degree in 1914. He received the Master of Arts degree in 1916 and the Doctor of Philosophy degree in 1918 from the University of Illinois. He also holds the honorary degree of Doctor of Science from Miami University.

Joining the staff of Abbott Labora-

Dr. Ernest H. Volwiler

Having Trouble With Your LIME FINISH or GREASE STICK?

We're a small firm . . . still a newcomer in the industry. But, Schaffner's staff are specialists, each with up to 15 years experience manufacturing buffing and polishing compositions. We aren't bragging, but we know our business.

We specialize in LIME (White) FINISH and GREASE STICK

For a MIRROR FINISH on Bronze, Nickel, Silver, Monel Nickel Silver and any soft metals.

BETTER TRY Schaffner COMPOUNDS

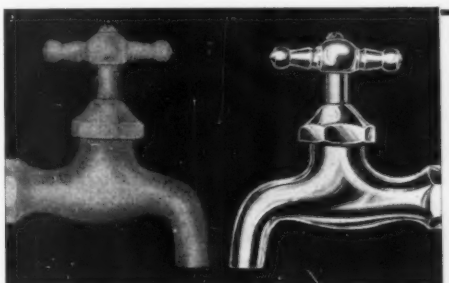
UP TO 100% SAPONAFIABLE PER YOUR SPECIFICATIONS

LET US SEND YOU A FREE SAMPLE

AGENTS! Some choice areas open . . . Your inquiry welcome.

THE Schaffner MFG. CO.

900 SCHAFFNER BLDG., EMSWORTH, PITTSBURGH 2, PA.



LUSTREBRIGHT

BRIGHT NICKEL PROCESS

Produces Brilliant, Lustrous Nickel Deposits.
Eliminates Color Buffing—Re-Cleaning—Re-Racking.
An Ideal Base for Chromium. Excellent Throwing Power.
No Special Solutions or Changes in Equipment Required.
Easy to Control—Low in Cost—Successful—Practical.

Uniform results obtained on all classes of work in still tanks or mechanical barrels. Excellent for zinc die-castings. Your present cold or lukewarm nickel solution will, with the addition of LUSTREBRIGHT, produce brilliant, lustrous, adherent deposits. Guaranteed not to harm plating solution. Will not cause plate to peel, become brittle, or produce streaky deposits. Illustration shows unbuffed deposits produced before and after addition of LUSTREBRIGHT. Write for complete information.

W. C. BRATE COMPANY

14 MARKET ST. Est. 1860 ALBANY, NEW YORK

tories as a research chemist in 1918. Dr. Volwiler was made chief chemist in 1920, director of research in 1930, and vice-president in charge of research and development in 1933. He became executive vice president in 1946. His work has been concerned with such varied products as vitamins, hormones, sulfonamides, antisyphilitic drugs, anticoagulants, and more recently antibiotics.

Winner of a modern Pioneer Award conferred by the National Association of Manufacturers in 1940, Dr. Volwiler received the Honor Scroll Award of the American Institute of Chemists in 1947 for his contributions to medicinal chemistry and his outstanding work in the organization of research programs.

He is a member of Phi Kappa Tau, Alpha Chi Sigma, Phi Beta Kappa, Gamma Alpha, the Washington Academy of Sciences, Northwestern University Associates, and Beta Gamma Sigma, and is director of the Liberian Institute of the American Foundation for Tropical Medicine, Inc.

Manufacturers' Literature

New Bulletin on Belke Barrels for Deburring, Burnishing, Drying

Belke Manufacturing Company, 947 N. Cicero Avenue, Chicago 51, Illinois.

Gives complete information on Belke Barrels for Deburring, Burnishing, Cutting Down, Drying, and Tumbling. Tells how they reduce finishing time, produce a more uniform finish with fewer rejects, and effect substantial savings in labor.

Copy of Bulletin 590 mailed promptly on request.

Booklet on Plating Supplies and Equipment

Udylite Corp., Dept. MF, 1651 E. Grand Blvd., Detroit 11, Mich.

A new bulletin issued by this firm illustrates various types of electroplating and finishing processing equipment. Included are barrel units in single and automatic transfer types, semi and full automatic plating units, automatic polishing machines, generators, rectifiers, and control equipment, filters, rod agitators, handling baskets and screens, and cleaning and pickling machines. Copies are available on request.

Chemical Process Equipment

General Ceramics and Steatite Corp., Dept. MF, Keasbey, N. J.

The above firm has just issued Bulletin No. CHE-R3, graphically illustrating its complete line of chemical process equipment.

Featured in the two-color, 12-page booklet are full specifications for General Ceramics chemical stoneware, chemical porcelain and impregnated graphite, known commercially as Ceraware, Cerawite and Impervite, respectively. The company's complete line of porcelain, an armored chemical stoneware vacuum pump and compressor and impervious graphite, new additions to General Ceramics' fast-growing line, are clearly illustrated and described in detail. The Muriatic Acid

HOLLAND SAYS:
REDUCE OPERATING COSTS!
Plating Tank Rheostats.
Various sizes—with and without meters.
Write for FREE folder "P" showing our wide selection of metal finishing equipment.
J. HOLLAND & SONS, INC.
MANUFACTURERS • DEALERS
274 SOUTH NINTH ST. • BROOKLYN, N. Y.

Convert your Polishing Lathe To the Abrasive Belt System
With this new heavy duty Production backstand — Reversible for right or left hand installation. 12 inch cast aluminum pulley takes belts up to 6 inches wide. Remote control belt tracking device is adjustable for belts up to 14 feet long.
Write for bulletin MF-11 for full details.
Production
MACHINE COMPANY GREENFIELD, MASSACHUSETTS, U.S.A.

Absorption System designed by General Ceramics is presented in a clear-cut diagram.

Pointed out in the bulletin are the important advantages of the single supply source for chemical process equipment, offered by General Ceramics. They include uniformity of construction, guaranteed fitting of all units, lower shipping costs through consolidation of orders, and reduced paper work and accounting.

General Ceramics and Steatite Corporation will gladly send a copy of Bulletin No. CHE-R3 upon receipt of request on your own letterhead.

Rebuilt Motors and Generators

L. J. Land, Inc., Dept. MF, 148 Grand St., New York 13, N. Y.

The above firm has just issued a listing of rebuilt motors, generators, transformers, starters, hoists, and compressors that they are in a position to supply from stock for immediate shipment. Their line of motors include squirrel cage types, slipring motors, synchronous motors, and variable speed motors in various voltages. The D.C. generators run from 6 volts to 600 volts. For a complete listing, write for List 15R.

Plating Racks

Duggan Masking Devices, Dept. MF, 2030 W. Fort St., Detroit, Mich.

This firm has issued a new bulletin describing their line of racks and rack making facilities. The company specializes in the design and construction of efficient, carefully engineered plating racks for high production needs, including racks of complicated and special designs. Also manufactured by this firm is a complete line of masking and stop-off devices for use in production of multi-finish effects. Copies of the bulletin describing their products are available on request to the above address.

Conveyors and Loading Devices

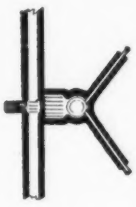
Triangle Equipment Co., Dept. MF, 45 River Road, Nutley, N. J.

A bulletin just issued by this firm describes their line of overhead and gravity conveyors, load hoists and boosters. Various types are available to aid in the rapid and economical moving of bulky or heavy parts, and the units are specially designed for the smaller plant where portability and wide range of utility are important. Changing the position is a matter of a minute or so with these units, and their compact design enables them to be moved through small passageways, besides taking up very little storage space when not in use. Copies of this descriptive literature showing typical applications and giving complete engineering details are available without charge.

News from California

Siefen Co. Appoints California Representative

Announcement was made recently by the *J. J. Siefen Co., of Detroit, Mich.*, of their appointment of *Mr. O. J. Jacobsen* as their representative in the West Coast area. Mr. Jacobsen has the exclusive handling of the firm's entire line of polishing and buffing compounds, and maintains offices at 122 E. 7th St., Los Angeles, and 428-



A COMPLETE PLATING RACK SERVICE

Insulation Service
All types

Plating rack parts
copper—bronze wire

Studs—hooks—tips
brackets—bumpers

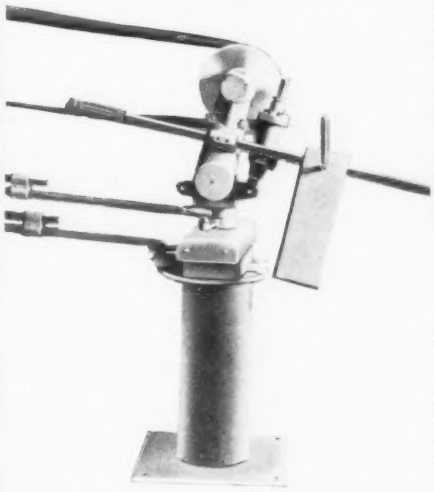
Everything for Racks

Write for price list
and catalog.

"Racks is our business".

STANDARD PLATING RACK CO.
1913-25 N. PAULINA ST.
CHICAGO 22, ILL.

Niederst Back Stand Idler
DESIGNED AND BUILT FOR
FASTER—SMOOTHER POLISHING
plus
VERSATILITY



Backed by eighteen years experience in the abrasive polishing field, the NIEDERST BACK STAND IDLER offers the utmost in both dependability and productiveness.

Features include:
Bearing Speed Reduced 33%
Accurate Belt Tension
Interchangeable Idler
Dual Remote Control Operation

Write for Specification Sheet and information for introducing belt polishing on your present lathe equipment.

NIEDERST COMPANY
3508 So. Michigan Avenue, Chicago 15, Ill.

O. J. Jacobsen

13th St. in Oakland, Calif. He is equipped with the materials and training to render prompt and efficient service to customers in this area.

Hammond Opens West Coast Office

To better serve the west coast metal finishing industry, *Hammond Machinery Builders, Inc., of Kalamazoo, Mich.*, has opened a new office at 1021 East 8th Street, Los Angeles 21, Calif.

Mr. E. C. Hammett has been appointed western representative. His knowledge of metal finishing and of grinding and polishing machinery will prove to be of great value to the west coast metal finishing field.

L. H. Butcher to Handle Fleetkleen Line of Filters

Co-Operative Industries, Inc., of Chester, N. J., have recently announced that the *L. H. Butcher Co.*, with sales outlets in San Francisco, Los Angeles, Seattle, Portland, and Salt Lake City, will handle and service their line of Fleetkleen filters for industrial uses. These filters are of the stone filtering element type, which eliminates the need for filter aids, paper, pads, etc., and are easily cleaned by backwashing with water. Complete units with pumps, tanks, and filter are available in this line.

The plating department of the *Quelledge Machine Company*, Santa Ana, Calif., has been purchased by *Carroll McLaren*, who for the past several months has served as plating superintendent of the Auto Service Company, Honolulu, H. I.

McLaren planned to take control January 1 and operate the plant as the only job plating shop in the city of Santa Ana. The plant is well equipped for job plating automotive parts, hardware and plumbing fixtures. Equipment consists of half a dozen large solution tanks, a 1600 ampere generator and two polishing lathes. McLaren formerly was plating superintendent for various concerns in the Los Angeles area, including Grayson Heat Controls, Inc., Lynwood, and Cannon Electrical Development Co., Los Angeles.

California Corrosion Laboratories have been established at 837 So. Mariposa Avenue, Los Angeles, by *William Weiss*, formerly a consultant chemist for Western Reserve Laboratories, Cleveland, O. Mr. Weiss has equipped his Los Angeles laboratory for making experiments toward development of corrosion preventers for the metal finishing industry, and plans ultimately to go into the production end in corrosion deterrants and preventers.

Fast Fool-Proof
Treatment for Cyanide Zinc Solutions

McKeon's
Zinc-Brite
TRADE MARK REG'D.

Cuts down proprietary brightener necessary.

Simple
Efficient
Economical

Sulphur Products Co. Inc.
Greensburg 7, Pa.

Unsurpassed for Dependable Accuracy

Filpaco
FILTER PAPERS

FILTER CLOTHS,
CLOTH BAGS, ASBESTOS PADS
and other filter media

For all types of plating solution filters . . . cut to any size and pattern . . . light and heavy weights . . . large stock maintained . . . samples furnished upon request, for experimental purposes.

Write for quotations today.

Other "FILPACO" Products:
Filters, stainless steel storage and mixing tanks, fillers, pumps, conveyors, fittings, filter paper, filter cloth, asbestos pads and filter aids.

THE FILTER PAPER CO.
2417 S. MICHIGAN AVENUE CHICAGO 16, ILLINOIS

Los Angeles branch office and warehouse of the *Detrex Corp.* of Detroit have been moved to 625 *S. Anderson Street.* The company manufactures and distributes Triad or Perm-A-Clor degreasing solvents, Detrex Alkali and emulsion cleaning compounds.

Werner H. E. Hahne recently was named manager of sales and engineering for the *G. C. Breidert Co.*, Los Angeles, manufacturers of the BreiDert Air-X-Hausters and other industrial ventilating units. He formerly served on the consulting engineering staff of the *Frank J. Lopker Company*, Los Angeles.

The Breidert Company operates a well-equipped finishing department at its plant, 3129 San Fernando Road. The shop is equipped with spray booths for painting ventilators and facilities for handling special alloys and finishes designed for corrosion and temperature conditions, both in Southern California and in the national market. George M. Breidert, son of the owner, is supervisor of the finishing division.

TECHNICAL LITERATURE

New Booklet on Abrasive Surfacing

Lea Mfg. Co., Dept. MF, 16 Cherry Ave., Waterbury 86, Conn.

The Lea Mfg. Co., specialists in the field of polishing, buffing and burring, has just published a very comprehensive practical book on the subject of finishing metals, plastics and wood. Covering some 160 pages and profusely illustrated and documented, this work is, in effect, a textbook for all industry. It presents an up to date treatment of the subject, and should be exceptionally useful to all those with finishing problems.

The book is divided into three sections:

Section 1—General discussion of finishing, the Lea method, terminology, and the finishing characteristics of metals, plastics and wood. A section on the finishing of "electrodeposited metals" is of special interest.

Section 2—Case studies showing how 125 companies have improved finishes and reduced finishing costs.

Section 3—Detailed discussion of finishing and plating materials and how they should be used. This is a general treatment, and covers not only Lea materials, but those of other manufacturers as well.

This book is for sale and is priced at $5.00 per copy. Orders should be sent direct to the above address, accompanied by your check or money order.

ANNUAL EDUCATIONAL SESSIONS & BANQUETS OF THE A. E. S.

•

CHICAGO BRANCH
STEVENS HOTEL, CHICAGO, JAN. 15, 1949

•

GRAND RAPIDS BRANCH
PANTLIND HOTEL, GRAND RAPIDS, JAN. 29, 1949

•

DAYTON BRANCH
MIAMI HOTEL, DAYTON, FEB. 12, 1949

•

NEW YORK BRANCH
STATLER HOTEL, NEW YORK, FEB. 26, 1949

•

BOSTON BRANCH
STATLER HOTEL, BOSTON, APRIL 16, 1949

POLISHING SPECIALISTS

During our 50 years practical experience in the polishing rooms throughout North America we have noted many changes. While the machines have revolutionized the industry, there will always be hand jobs where the fundamentals are about the same as they were many decades ago. Here there are no further short cuts available other than those known to competent metal finishing authorities.

We have a complete line of wheels and polishing wheel service is always available to our customers.

The trend of the times is on the way back to a better finish, so for good polishing write for our catalog.

PRESSED LEATHER WHEEL CO.

HERKIMER, N. Y.

Oldtime Polishers *Old Wheel Builders*

CHRISTMAS GREETINGS

We acknowledge with sincere thanks the good wishes from our many friends listed below:

Allbright Associates
M. E. Baker & Co.
Frank Bauer
L. G. Beresford
George Black
Fellows-Bogardus Co.
T. R. Boggess
Divine Bros.
George Dubpernell
Edward T. Faint
Fred Fulforth
Daniel Gray
Fred Green
George W. Grupp
Handy and Harmon
Mr. and Mrs. George B. Hogaboom
Samuel S. Johnson
Mr. and Mrs. Bob Leather
Joseph B. Kushner
The LoPresti Family
Manhattan Rubber Co.
J. B. Mohler
Marmon-Herrington Corp.
Gerald McCray
W. D. MacDermid
Munning and Munning Co.
New Haven Branch A.E.S.
Oakite Products Corp.
Robert F. Powers
Staff of Plating Magazine
H. K. Porter Co.
Pittsburg-Corning, Inc.
Benjamin F. Postman
Rapid Electric Co.
Reynolds Metals Co.
Andrew V. Re
Howard Sanders
Sander-Rodkin Adv. Agency
William R. Shields Co.
Arthur P. Schulze
H. R. Smallman
Sulphur Products Co.
O. S. Tyson
Tutrone Printing Co.
Samuel Wein

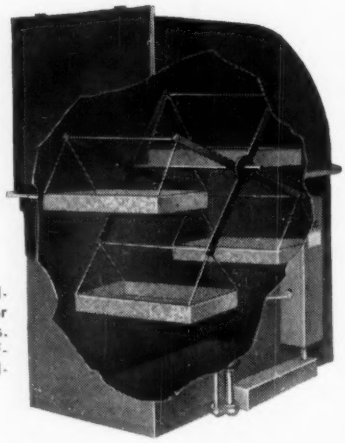
Obituaries

Hubert M. Rosencrans

Hubert M. Rosencrans, 59, assistant director of sales of the Grasselli Chemicals Department of the *Du Pont Company*, died Thanksgiving night at the University of Pennsylvania Hospital in Philadelphia. Mr. Rosencrans suffered a stroke while attending the Penn-Cornell game at Franklin Field and was removed to the hospital, where he died at 9:30 p.m. He was a resident of Springfield, Pa.

Born at Hamilton, Ohio, on April 6, 1889, Mr. Rosencrans received his bachelor of science degree from Miami University at Oxford, Ohio, in 1912. From 1912 to 1914 he was a chemist in the food and drug laboratory of the Health Department of New York City. He then went to the University of Wisconsin, where he received his master of science degree in chemistry in 1915. He played varsity basket-ball and tennis.

In March, 1916, Mr. Rosencrans went to work as a research chemist at the Grasselli, N. J., plant of the Grasselli Chemical Company. In 1918 he was transferred to the laboratory at Cleveland and in 1920 he joined the sales department. When the Du Pont Company acquired the Grasselli Chemical Company in 1928, Mr. Rosencrans was assistant to the vice-president in

PHILLIPS
Rotomatic Vapor Degreaser
CONVEYORIZED PERFORMANCE
PHILLSOLV
Controlled cleaning Cycle!
Open top degreaser cost!
Timed for proper cleaning!
75% reclamation of solvent!
Great economizer of labor!
No installation costs!
PHILLSOLV . . . the perfect cleaning solvent for all metals or combinations of metals. PHILLSOLV will not affect or stain highly polished surfaces.

ENGINEERED SERVICE
Send for FREE Booklet "Questions and Answers on Vapor Degreasing"
PHILLIPS MANUFACTURING CO.
3463 W. TOUHY AVE. CHICAGO 45, ILLINOIS

JOSEPH B. KUSHNER Ch. E.
Metal Finishing Engineer
Offers YOU the OPPORTUNITY to ADVANCE with
"ELECTROPLATING KNOW-HOW"
A new correspondence course in modern electroplating, personally conducted by this well-known Metal Finishing Engineer.
Write today for Free Particulars
JOSEPH B. KUSHNER, Metal Finishing Engineer
Stroudsburg 3B, Pa.

STRIPODE
STRIPS NICKEL *FASTER, BETTER*
Stripode Addition Agent speeds up regular Sulphuric Acid baths . . . cuts acid consumption . . . protects base metal . . . prevents pitting and roughening . . . often eliminates need for polishing and buffing.
Write for full information.
S-80
THE CHEMICAL CORPORATION
54 Waltham Ave., Springfield, Massachusetts

charge of sales. He became western division sales manager in 1930.

In 1936 the Grasselli Chemical Company was dissolved, and was succeeded by the Grasselli Chemicals Department of Du Pont, with headquarters at Wilmington, Del. Mr. Rosencrans moved to Wilmington in 1937 as assistant sales manager in charge of acids and heavy chemicals. In 1944 he became assistant director of sales in charge of agricultural chemicals, zinc, adhesives, and resale products. In this capacity, he took part in the development of new insecticides, fungicides, and weed-killers.

Louis C. Sommers

We report with deepest regret the death of Mr. Louis C. Sommers, Secretary and Treasurer of the Sommers Bros. Mfg. Co., 3443 North Broadway, St. Louis, Mo. Mr. Sommers passed away on the 14th of November, after a long and varied career in the electroplating supply and equipment business.

DEVELOPMENTS IN 1948

References

(*Concluded from page* 53)

1. *Chemist*—Metal Industry (London), April 9-23, 1948, pp. 286-288, 326-329.
2. *J. Kushner*—Metal Finishing, Jan. 1948, p. 63; July 1948, p. 55; Sept. 1948, p. 52.
3. *R. E. Webb* and *H. B. Linford*—Journal Electrochem. Soc., Vol. 94, Nov. 1948, p. 261.
4. *A. T. Steer*—Electroplating (London), Vol. 1, No. 12, Oct. 1948, p. 629.
5. *A. T. Steer*—Metal Finishing, July 1948, pp. 62-70.
6. *E. M. Mahla* and *N. A. Nielsen*—Journal Electrochem. Soc., Vol. 93, No. 1 Jan. 1948.
7. *F. Keller & J. D. Edwards*—Metal Progress, August 1948, p. 195.
8. *S. Wein*—Metal Finishing, Feb. 1948, p. 71; April 1948, p. 76.
9. *P. Berger*—Metal Finishing, Dec. 1948, p. 72.
10. *M. Halfawy*—Electroplating, March 1948, p. 205.
11. U. S. Patent 2,429,676—*C. L. Faust.*
12. U. S. Patent 2,440,715—*C. L. Faust & P. D. Miller.*
13. U. S. Patent 2,442,591—*A. L. Field.*
14. U. S. Patent 2,442,592—*A. L. Field.*
15. Lustrik Process—*Parker Rust Proof Co., Detroit, Mich.*
16. Enthone No. 140 Process—*Enthone, Inc., New Haven, Conn.*
17. U. S. Patent 2,433,723—*T. J. Wieczorek.*
18. U. S. Patent 2,446,060—*H. A. H. Pray, I. Igelsrud,* and *G. L. Simard.*
19. Pangborn Corp., Hagerstown, Md.
20. *J. Albin*—Metal Finishing, March 1948, p. 54.
21. U. S. Patent 2,431,595—*W. E. White.*
22. U. S. Patent 2,442,802—*N. L. Evans.*

If interested in additional profits

BABY SHOE PLATING

Merits Your Investigation

***Hollywood* BRONZE SUPPLY**

pioneers in metal and onyx mountings for Bronzed Baby Shoe Industry . . .

Distributors of Ramyr Selenium Rectifiers.

Write for catalogue

***Hollywood* BRONZE SUPPLY**

1770 N. Vermont Ave. Hollywood 27, Calif.

All TYPES of Buffs!

BIAS • TREATED • POCKET
COLORED • PIECED • FLANNEL
SPIRAL • LOOSE • SHEEPSKIN

Only NEW sheeting is used in the manufacture of AMATEX Buffs!

Type	*Count*	*Weight*
Sunlite	64-64	3.15
Arrow	80-80	4.00
Mercury	80-92	3.50
Harvest	48-48	2.85
Fortress	69-74	2.85
Viking	86-93	2.60

Write to us for extremely low prices on Full Disc Spirally Sewed Buffs

PROMPT DELIVERIES

AMATEX
BUFF COMPANY, INC.
28 West Third St., New York 12, N. Y.
ALgonquin 4-8851

H. W. KRAMER CO.

Chamois, Sheepskin, Cotton **BUFFING WHEELS** Felt, Lead Center, Cloth

Carving, Beveling **MACHINES AND TOOLS** Polishing Motors

Tumbling Shot (All Shapes) Wood Pegs For Tumbling

120-28 Jamaica Ave. Richmond Hill 18, N. Y.

pH PAPERS

are now available again!

Accurate—Convenient—Time-saving

they check pH almost instantaneously right at the tank.

Available ranges (200 strips per box)

Acid:	Alkaline:
5.0-6.4	6.6- 8.1
3.8-5.2	8.2- 9.7
2.6-4.4	8.8-11.3
1.6-3.7	11.0-13.1

Each range is boxed separately.

PAUL FRANK

118 East 28th Street
NEW YORK 16
Tel. MU 9-5286

DIXRIP

FINE WIRE SCRATCH BRUSHES

CUP BRUSH

Clean or polish those hard to get at places with a Dixrip cup brush. Made in 2, 3 or 4 rows of fine brass, steel or nickel silver wire. Just give us the diameter of the spread, size wire and number of rows and solve your brushing problems.

Ask for Dixrip Brushes at your supply house or write us for catalogue and price list.

DIXON & RIPPEL, INC., KINGSTON, N. Y.

ESTABLISHED 1856

New!! Improved!!

RACK COATING

Paraline BW (all purpose)

1. GREATER ADHESION.
   Laboratory tests show adhesion improved up to 200%.
2. DENSE.
   Non-porous, higher dielectric strength.
3. BRILLIANT GLOSSY FINISH.
   Further reduces drag-out.
4. SUITABLE FOR COMPLETE PLATING CYCLE.
   Eliminates re-racking.

SAVE MONEY—IMPROVE YOUR PLATING OPERATIONS

Look for the Red Dot

The BARBER-WEBB Co.
8686 RHEEM AVE. SOUTH GATE, CALIF. LUcas 9126

23. U. S. Patent 2,442,195—*J. T. Clenny.*
24. *K. Weller,* Metal Finishing, June 1948, p. 95.
25. *C. A. Zapffe*—Metal Progress, June 1948, p. 833.
26. U. S. Patent 2,443,651—*J. J. Cannizzaro.*
27. *L. S. Darken* and *R. P. Smith*—Paper presented before National Association of Corrosion Engineers, April 1948.
28. *P. De Lattre*—Sheet Metal Industries, October 1948, p. 1964. Nov. 1948, p. 2181.
29. *P. H. Cardwell* and *L. H. Eilers*—Industrial and Engineering Chemistry, Oct. 1948. p. 1951.
30. *S. Spring* and *L. F. Peale*—Industrial and Engineering Chemistry, Nov. 1948, p. 2099.
31. *A. B. Middleton*—Die Casting, January 1948, p. 65.
32. *I. Reich* and *F. D. Snell*—Industrial and Engineering Chemistry, July 1948, p. 1233, Dec. 1948, p. 2333.
33. *D. E. Durkin*—Materials and Methods, April 1948, p. 82.
34. *A. H. Pope*—Metal Finishing, October 1948, p. 75.
35. *D. Price*—Metal Finishing Guidebook & Directory, 1948, p. 385.
36. *J. Hyypia*—Analytical Chemistry, Nov. 1948, p. 1039.
37. *T. Barr, J. Oliver, W. V. Stubbings*—Journal Soc. Chem. Ind., Feb. 1948, p. 45.
38. *M. Shapiro*—Metal Finishing, Feb. 1948, p. 56.
39. A.E.S. Research Report—Plating, May 1948, p. 463.
40. A.E.S. Research Report—Plating, June 1948, p. 569.
41. U. S. Patent 2,434,021—*M. M. Thompson* and *W. E. Moline.*
42. *G. W. Jernstedt*—Plating, July 1948, p. 708.
43. U. S. Patent 2,443,599—*A. E. Chester.*
44. *H. K. DeLong*—Metal Finishing, July 1948, p. 46. Patented.
45. U. S. Patent 2,437,612—*H. Osborg.*
46. U. S. Patent 2,438,740—*C. W. Clark* and *W. A. Sheaffer.*
47. U. S. Patent 2,430,468—*E. M. Julich* and *W. A. Mehmel.*
48. British Patent 601,825—*C. T. Suchy.*
49. British Patent 597,443—*A.E.R., Ltd.*
50. U. S. Patent 2,446,349—*T. P. Weir* and *F. H. Hurley.*
51. U. S. Patent 2,446,350—*T. P. Weir.*
52. *W. E. Clark* and *M. L. Holt*—Journal Electrochemical Society, Nov. 1948, p. 244.
53. *M. H. Lietzke* and *M. L. Holt*—Journal Electrochemical Society, Nov. 1948, p. 252.
54. *M. L. Holt* and *R. E. Black*—U. S. Patent 2,432,894.
55. *M. L .Holt* and *M. L. Nielsen*—U. S. Patent 2,432,893.
56. *H. Silman*—Metal Industry (London), July 16, 1948, p. 48.
57. *J. W. Cuthbertson* and *R. M. Angles*—Journal Electrochemical Society, Aug. 1948, p. 73.
58. U. S. Patent 2,446,716—*J. S. Nachtman.*
59. *J. W. Cuthbertson*—Journal Electrodepositors Tech. Soc., 1948, 23, 143-150.
60. *W. H. Sawyer*—Journal Electrodepositors Tech. Soc., 1948, 23, 151-162.
61. U. S. Patent 2,435,967—*G. W. Jernstedt.*
62. U. S. Patent 2,436,316—*J. C. Lum* and *G. W. Jernstedt.*
63. *R. Seegmiller* and *V. Lamb*—Paper presented at Amer. Electroplaters Annual Convention, June 1948.
64. U. S. Patent 2,430,750—*T. H. Webersinn* and *J. Hyner.*
65. U. S. Patent 2,450,296—*F. Passalacqua.*
66. *K. S. Willson, A. H. DuRose* and *D. G. Ellis*—Plating, March 1948, p. 252.
67. U. S. Patent 2,437,865—*J. E. Stareck.*
68. U. S. Patent 2,439,935—*T. R. Jones* and *N. R. Bierly.*
69. U. S. Patent 2,452,361—*J. R. Dyer.*
70. *F. C. Mathers* and *J. C. Griess*—Journal Electrochemical Soc., Nov. 1948, p. 46N.
71. *F. C. Mathers* and *J. F. Suttle*—Journal Electrochemical Soc., Feb. 1948, p. 47.

High Output
Selenium Rectifiers
• International R.C. selenium rectifiers are engineered to meet individual requirements. Wide range of voltages and current ratings available. Samples supplied promptly.
International Rectifier Corporation
68th & Victoria Ave., Los Angeles 43

OXY-DYZ-ENE
TRADE MARK REGISTERED
HIGHEST STRENGTH
OXIDIZING AGENTS
POSSIBLE TO PRODUCE
Sold in LUMP and LIQUID FORMS by Leading Plater Supply Houses
Manufactured For 68 Years By
KREMBS & COMPANY
669 W. OHIO ST. CHICAGO, U.S.A.

BUYERS
of any QUANTITY
of the following SCRAP
Ni—Anodes
Ni—Peelings . . . Strippings . . . Nodules . . . Trees
Cr—Strippings . . . Nodules . . . Trees
Ni—Deposited on iron-hooks . . . Racks . . . Hangers
Tin—Plating Residues
Cadmium—Trees . . . Strippings . . . Nodules . . . Trees . . . Residues
Molybdenum—Tungsten
Gold—Silver
Platinum—Scrap . . . Residues . . . Strippings
★
Write indicating grade and quantity available
METALLURGICAL PRODUCTS CO.
Established 1909
35th & Moore Sts., Phila. 45, Pa.

Hartford GUARANTEED
STEEL BALLS
Best for Burnishing . . . Perfect for Polishing. No culls, no cracks.
Mixtures as Required
THE HARTFORD STEEL BALL CO.
HARTFORD 6, CONN.

SOMMERS BROS. MFG. CO.
MFRS. OF "BEACON"
Plating and Polishing Supplies and Equipment—Complete Semi and Full Automatic Installations—Gold, Silver and Chrome Rouge, Stainless Steel and Satin Finish Compounds—Buffs, Polishing and Felt Wheels.
WRITE FOR PRICES
3439 NO. BROADWAY
ST. LOUIS 7, MO.

Zialite
Reg. U. S. Pat. Office
FOR NICKEL PLATING
The one bath especially designed for plating diecastings made of WHITE METAL ALLOYS including ZINC, LEAD, and ALUMINUM. ZIALITE also plates on COPPER, BRASS, and IRON.
USE
Zialite
ADDITION AGENTS
for
HARD CHROMIUM BATHS
Finer-grained deposits.
Increased throwing power.
Less sensitivity to sulfate content.
ZIALITE CORPORATION
92 Grove Street, Worcester 5, Mass

72. *C. B. F. Young* and *E. S. Roszkowski*—Journal Electrochemical Soc., Oct. 1948, p. 176.
73. *W. A. Wesley* and *H. R. Copson*—Journal Electrochemical Soc., July 1948, p. 20.
74. U. S. Patent 2,436,690—*A. H. DuRose.*
75. U. S. Patent 2,449,422—*L. N. Smith.*
76. U. S. Patent 2,426,416—*E. W. Schweikher.*
77. *D. T. Ewing, R. Rominski, W. King*—Plating, Nov. 1948, p. 1122.
78. U. S. Patent 2,452,308—*G. C. Lambros.*
79. U. S. Patent 2,440,672—*H. J. Green.*
80. *A. Levin*—Electroplating, May 1948, p. 315.
81. U. S. Patent 2,431,947—*W. M. Martz.*
82. U. S. Patent 2,449,726—*A. D. Slatkin.*
83. U. S. Patent 2,432,718—*N. F. Blackburn.*
84. U. S. Patent 2,450,794—*E. F. Harris.*
85. U. S. Patent 2,450,795—*E F. Harris.*
86. U. S. Patent 2,446,983—*A. F. Prust.*
87. British Patent 600,356—*International Corrodeless, Ltd.*
88. *H. D. Carter*—Metal Finishing, Oct. 1948, p. 85.
89. U. S. Patent 2,443,600—*A. E. Chester.*
90. *H. F. Ross*—Metal Progress, Nov. 1948, p. 687.
91. U. S. Patent 2,434,191—*H. L. Benner & R. R. Bair.*
92. *G. Black* and *E. Rosen*—Metal Finishing, Aug. 1948, p. 70; Dec. 1948, p. 70.
93. U. S. Patent 2,430,475—*W. E. Marshall.*
94. U. S. Patent 2,430,304—*E. W. Schweiker.*
95. British Patent 597,443—*A.E.R., Ltd.*
96. Commonwealth Engineering Co., Dayton, Ohio—Processes Patented.
97. Electroplating—September 1948, p. 572.
98. U. S. Patent 2,438,740—*C. W. Clark* and *W. A. Sheaffer.*
99. *C. F. Powell, I. E. Campbell,* and *B. W. Gonser*—Journal Electrochem. Soc., June 1948, p. 258.
100. *W. C. Coppins*—Metal Industry, June 11, 1948, p. 482.
101. *R. B. Mason* and *C. J. Slunder*—Industrial and Engineering Chemistry, Dec. 1947.
102. *R. L. Burwell, Jr.* and *P. T. May*—Journal Electrochem. Soc., Nov. 1948, p. 195.
103. British Patent 597,049—Compagnie de Produits Chemiques et Electrometallurgiques Alais, Froges and Camargne.
104. *L. Whitby*—Metal Industry, May 14, 1948.
105. U. S. Patent 2,436,940—*Joseph Schulein.*
106. British Patent 597,177—*E. L. Mack.*
107. *A. L. Kohl* and *H. Waterman*—Iron Age, Jan. 22, 1948, p. 50.
108. British Patent 599,327—British Alum. Co., Ltd.
109. *M. A. Streicker*—Metal Finishing, Aug. 1948, p. 61.
110. *M. A. Streicker* and *N. F. Murphy*—Paper presented before American Electroplaters Convention, June 1948.
111. U. S. Patent 2,449,495—*J. C. Lum.*
112. Plating—February 1948, p. 156.
113. Plating, March 1948, p. 260.
114. Plating—October 1948, p. 1019.
115. Plating—May 1948, p. 458.
116. *W. A. E. McBryde* and *J. H. Yoe*—Analytical Chemistry, Nov. 1948, p. 1094.
117. *J. Sirota*—Metal Finishing, Sept. 1948, p. 68.
118. *S. B. Anisimov* and *L. P. Intson*—Electroplating, Aug. 1948, p. 527.
119. L. E. Lancy Laboratories—Metal Finishing, Dec. 1948, p. 84.
120. *J. B. Mohler*—Metal Finishing, Sept. 1948, p. 59.
121. *A. Brenner* and *E. Kellog*—Journal of Research, National Bureau of Standards.
122. *H. T. Francis*—Journal Electrochemical Soc., March 1948, p. 79.
123. British Patent 599,601—Birmingham Small Arms Co.
124. *H. J. Read* and *J. H. Thompson*—Plating, Sept. 1948, p. 922.
125. *A. L. Ferguson* and *M. V. Tsao*—Plating, July 1948, p. 724.
126. *N. Thon* and *D. Kelemen*—Plating, Sept. 1948, p. 917.
127. *A. Brenner* and *S. Senderoff*—Paper presented at A.E.S. Convention, June 1948.
128. *A. K. Graham* and *R. Lloyd*—Plating, May 1948, p. 449.
129. *E. B. Bergsman*—Metal Progress, Aug. 1948, p. 183.
130. *E. A. Ollard*—Journal Electrodepositors Tech. Soc., 1949. 24, 1-8.
131. *H. L. Faigen*—ASTM Bulletin, Oct. 1948, p. 39.
132. British Patent 596,160—*E. G. Stroud* and *W. H. J. Vernon.*
133. British Patent 600,328—Shell Development Co.
134. British Patent 603,067—*C. A. Frankenhoff.*

ALUMINUM

Do you Buff Aluminum?

Do you want a perfect surface for coloring?

Our "NEW" Aluminum TRIPLE-ROUGE WILL DO THE JOB

#528 cut and color compound for high speed

#527 cut and color compound for low speed

This product is a brand new fast-cutting formula with a very high melting point and will not soften on Automatic Machines which are enclosed, and where there is intense heat.

Send for Sample
Specify Size

UNITED LABORATORIES COMPANY
LINDEN, NEW JERSEY
Linden 2-4059 Barclay 7-7159 Roselle 4-0099

GRANIUM

A Precious metal complex salt for Silver & Gold Plating
Used as an additive
Harder Plate
Tarnish Resistant
Cyanide & Anodes

Write for booklet.

GRANIUM PRODUCTS
4427 Ledge Avenue
North Hollywood, Calif.
Chemical Engineers since 1905

INDIAN BRAND
TURKISH EMERY

This old time famous brand of emery is now in stock. Many have been waiting for it. Also available are POLISHING ABRASIVE—best for finest finishing and AMERICAN EMERY—most economical.

HAMILTON
EMERY & CORUNDUM COMPANY
Chester Mass.

BUFFS, CLEANERS

BUFFING COMPOSITIONS
NICKEL ANODES
CHEMICALS AND GENERAL SUPPLIES

JACOB HAY COMPANY
4014 W. Parker Avenue
Chicago, Ill.
Albany 2742

CEILCOTE

CORROSION PROOF CONSTRUCTION

Acid, Alkalis and Solvent Proof Cements, Linings and Protective Coatings installed complete to afford long maintenance-free operation under the most severe operating conditions.

WRITE
THE CEILCOTE COMPANY
612 SUPERIOR AVE. N. W.
CLEVELAND 13, OHIO

SEND FOR A LIST OF BOOKS ON FINISHING

Metal Finishing, 11 W. 42nd St., N. Y.

NICKELOID METALS (Pre-Plated)

NICKEL • CHROMIUM • BRASS • COPPER
Electro-plated TO ALL COMMON *Base* METALS
ALSO LACQUERED COLORS
SHEETS AND COILS

AMERICAN NICKELOID COMPANY
Established 1898 PERU, ILLINOIS

ADVERTISING RATES
Per column inch per insertion
1 time - - $7.50
3 times - - 7.00
6 times - - 6.50
Yearly (12 times) 6.00

READY-REFERENCE SECTION
—USED EQUIPMENT AND SUPPLIES—

ELECTROPLATING
POLISHING
RUST PROOFING
CLEANING
ANODIC TREATMENT
ETC.

AVAILABLE FOR IMMEDIATE SHIPMENT—ATTRACTIVE VALUES

THE FOLLOWING EXCELLENT REBUILT AND GUARANTEED ELECTROPLATING MOTOR GENERATOR SETS AND RECTIFIERS, WITH FULL CONTROL EQUIPMENT:

1—15,000/7500 Ampere, 6/12 Volt, Columbia Electric Company. Latest Design Unit, with Separate M. G. Exciter.

1—10,000/5000 Ampere, 25/50 Volt, Chandeysson Elec. Co. Synchronous Motor. 5 years old. Like New. Excellent for Anodizing.

1—5000/2500 Ampere, 6/12 Volt, Eager Electric Co. Separately Excited. Excellent Condition.

1—5000/2500 Ampere, 6/12 Volt, Munning "Optimus". Separately Excited.

1—4000/2000 Ampere, 9/18 Volt, General Electric Company. Synchronous Motor.

1—4000/2000 Ampere, 6/12 Volt, Hanson & Van Winkle Company. Compound Wound. Separately Excited.

1—3000/1500 Ampere, 6/12 Volt, Hanson-Van Winkle-Munning Co. Synchronous Motor, 6 years old. Separately Excited.

1—2000/1000 Ampere, 6/12 Volt, Hanson-Van Winkle-Munning Co. Synchronous Motor, 5 Years Old. Separately Excited.

1—1500/750 Ampere, 6/12 Volt, Hanson-Munning Co., Shunt Wound. Separately Excited.

2—1000/500 Ampere, 6/12 Volt, Charles J. Bogue Electric Co., Separately Excited. Interpole Design.

LARGE SELECTION OF SMALLER SIZES IN STOCK. WRITE FOR DETAILS.

1—1500 Ampere, 40 Volt, Hanson-Munning. Anodizing Synch. M. G. Set. Automatic Controls.

1—1000 Ampere, 40 Volt, Chandeysson. Anodizing Synch. M. G. Set. Automatic Controls.

1—1000 Ampere, 25 Volt, Hanson-Van Winkle-Munning Company. Separately Excited. Anodizing Unit.

OTHER SIZES OF ANODIZING M.G. SETS—in stock for Sulphuric or Chromic Acid Solutions—Large Selection. Write for details.

7—G. E. Copper Oxide Rectifiers, 500 Ampere, 6 Volts, for operation on 220/3/60.

12—400 Ampere, 6 Volt, Udylite-Mallory Rectifiers, with built-in Regulators.

1—2000 Ampere, 6 Volt, General Electric Co. Copper Oxide Rectifier for 220 volt, 3 phase, 60 cycle input.

2—1440/720 Ampere, 6/12 Volt, Udylite-Mallory Rectifiers, for 220/440 volt, 3 phase, 60 cycle input.

M. E. BAKER COMPANY
143 SIDNEY ST., CAMBRIDGE, MASS.

PRICED To SELL!
MOTORS
GENERATORS
Reliably Rebuilt
1 YEAR GUARANTEE

6/12 Volts

1—8000/4000 Ampere, H-V-W synch. M.D., 300 RPM.
2—6000/3000 Ampere, B. & O'C. with Chandeysson synch. motor, 450 RPM.
2—5000/2500 Ampere, B. & O'C. with Chandeysson synch. motor, 450 RPM.
1—5000/2500 Ampere, Columbia, 690 RPM.
1—2000/1000 Ampere, H-V-W, 690 RPM.
1—1250/625 Ampere, H-V-W, 850 RPM.
1—1000/500 Ampere, Columbia, 1150 RPM.
1—1000/500 Ampere, H-V-W, 1150 RPM
8—125 Ampere, Hobart, 6 volts.

12/24 Volts

1—1000/500 Ampere, H-V-W synch. M.D., 900 RPM.
1—6000/3000 Ampere, Chandeysson synch. M.D., 400 RPM.

15 to 25 Volts

1—200 Ampere, 15 V. Master.
1—1000 Ampere, 15 V. Gen. Elec.
1—300 Ampere, 15 V. Star.
3—1500 Ampere, 20 V. Elec. Prods.
2—3000 Ampere, 20 V. Elec. Prods.
1—800 Ampere, 22/33 V. Gen. Elec.
1—1500 Ampere, 24 V. Elec. Prods.
1—600 Ampere, 24 V. Reliance.
1—200 Ampere, 25 V. Star.
1—1000 Ampere, 25/35 V. Diehl.
1—300 Ampere, 25 V. Star.
1—175 Ampere, 25 V. Cr. Wh.

32 to 60 Volts

1—500 Ampere, 32 V. Columbia.
2—100 Ampere, 30 V. Gen. Elec.
1—200 Ampere, 30 V. West.
2—200 Ampere, 32 V. Gen. Elec.
2—1500 Ampere, 32/40 V. Elec. Prods.
1—1000 Ampere, 33 V. Gen. Elec.
2—200 Ampere, 42 V. Gen. Elec.
3—1500 Ampere, 45 V. Century.
1—1500 Ampere, 50 V. Gen. Elec.
2—800 Ampere, 50 V. Gen. Elec.
1—400 Ampere, 50 V. Gen. Elec.
6—1500 Ampere, 50 V. Elec. Prods.
1—1000 Ampere, 60 V. Gen. Elec.

L. J. LAND, Inc.
146-148 GRAND ST.
NEW YORK 13, N. Y.
CANAL 6-6976
ESTABLISHED 1910

FOR SALE
(AVAILABLE FOR IMMEDIATE SHIPMENT)

PLATERS' BARRELS (REBUILT)
Motor Drive—3 phase, 60 cycle, 220/440 volt

40—Mechanical "Horizontal Type" Single and Double barrel units—New and Used. Terrific assortment of Belke and Crowns.
7—UDYLITE "Utility" Platers
30—CROWN — BAIRD — LASALCO — Size No. 1 and No. 2—Ball Burnishers
2—CROWN Roto Finishing Machines
20—BAIRD—GLOBE "Oblique" Tumblers

POLISHING LATHES — NEW AND USED—CONSTANT AND VARIABLE SPEED, 3 phase, 60 cycle, 220/440 volt.

TUBE POLISHER — Production 101 — Motor Drive, complete. Capacity ¼" to 6". 3 phase, 60 cycle, 220/440 volt.

RECTIFIERS: General Electric, Mallory, Udylite, Selenium, 50 to 1500 ampere sizes, 6 volts with Regulators, 3 phase, 60 cycle, 220/440 volt.

PLATING MOTOR GENERATOR SETS (REBUILT)
WITH COMPLETE PANEL EQUIPMENT—MOTORS—3 phase, 60 cycle, 220/440 volt SYNCHRONOUS

1—CHANDEYSSON ELECTRIC 1000/500 ampere, 6/12 volt, 900 RPM. Exciter in head, 40 Deg. C. Serial No. 28874.

1—HANSON-VAN WINKLE-MUNNING 1500 ampere, 12 volt, 900 RPM. Exciter in head. Serial No. 9810.

1—HANSON-VAN WINKLE-MUNNING 2000/1000 ampere, 6/12 volt, 720 RPM. Exciter in head. Serial No. 9939.

1—L'HOMMEDIEU 3000/1500 ampere, 8/16 volt, 900 RPM. Exciter in head. Serial No. 1040.

1—HANSON-VAN WINKLE-MUNNING 4000/2000 ampere, 6/12 volt, 600 RPM. Exciter in head. Serial No. 9635.

2—Ideal Electric 5000/2500 ampere, 9/18 volt, 600 RPM. M.G. Exciter. Serial No. 112875—Serial No. 110705.

1—IDEAL ELECTRIC 1500 ampere, 20 volt, 1200 RPM. M.G. Exciter. Serial No. 110702.

ALSO—AVAILABLE—NEW & USED—GENERATOR SETS & RECTIFIERS—Ranging in Size from 50 to 6000 amperes.

WE CARRY A COMPLETE LINE OF NEW & USED PLATING AND POLISHING EQUIPMENT AND SUPPLIES.

CLINTON SUPPLY COMPANY
112 SOUTH CLINTON STREET
CHICAGO 6, ILLINOIS